BRITISH
AIRWAYS

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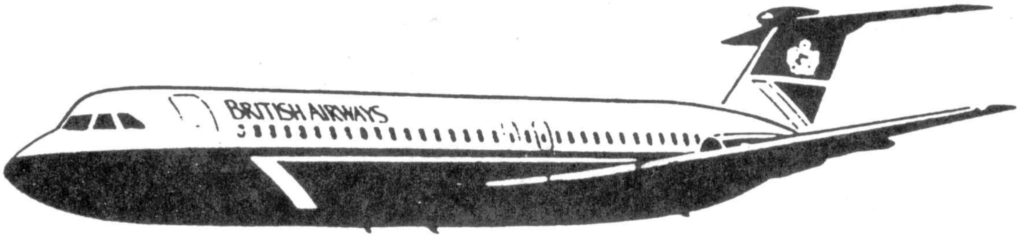

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This Manual complies with ANO (1985) Article 25, BCAR A6-7, CAP 360 and Technical Services Procedure T-DON-02-05. The inclusion of an uncertified revision will invalidate this certification.

Signed .... Head of Technical & Training Flight Crew
and where applicable, on behalf of Chief
Engineer Technical & Quality Services
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INTRODUCTION

The British Airways BAC1-11 fleet comprises 39 aircraft of 7 different types. Where differences of a minor nature occur between those types they are covered in the main text, either in the form of a margin note or by a specific type reference in the text. Where differences of a more complicated nature must be covered then a facing page is inserted with a description of the variation, and a reference to the relevant aircraft type.

For ease of reference by crews those difference pages which are relevant only to crews flying the Smiths equippped 510 series are printed on purple coloured pages, those for the Collins equipped aircraft are on blue pages and those which are relevant to both crews are on green pages. Therefore 510 crews may ignore the blue pages and crews flying the Collins equipped aircraft can ignore the purple pages.

The only exception to the above system is in the FCS and Radio chapter where the variations are so extreme that there are two seperate chapters, 6A for the Smiths system and 6B for the Collins.

The type numbers used throughout are those assigned by the manufacturer and they are included here for information, with a cross-reference to aircraft registration

400 series;	AVGP AWBL BBME BBMF BBMG
501 series;	AWYR AWYS AWYT AWYU AWYV AXJK AXJM
510 series;	AVMH AVMI AVMJ AVMK AVML AVMM AVMN AVMO AVMP AVMR AVMS AVMT AVMU AVMV AVMW AVMX AVMY AVMZ
515 series;	AZPZ
523 series;	AXLL
528 series;	BJRT BJRU
530 series;	AYOP AZMF
539 series;	BGKE BGKF BGKG

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ACCOMMODATION AND EQUIPMENT

GENERAL. The accommodation is divided into the flight deck, the passenger compartment with toilets and catering facilities, and, below the floor, freight holds and equipment bays. All this accommodation can be pressurised.

DOORS AND HATCHES

Forward Passenger and Service Doors. Both doors, similar in construction and operation, are held in the closed position by matching sets of lugs on the sides of the doors and frames: these lugs are disengaged by lifting the door in its frame. The door is prevented from rising by the engagement of a safety latch when in the closed position. To open a door, press down either the internal or external handle on the door: initial handle movement releases the safety latch and allows further handle movement to lift the door in its frame and disengage the lugs, and the door can then be swung outwards and forward (port) or aft (stbd). Each door swings parallel to the fuselage on a main hinge beam, and is latched in the fully open position; once a door starts to move outwards, it is held up by a latch. The external handle has to be pulled out of its recess to engage the operating mechanism, and the recess should be used as a hand hold when pulling the door open.

To close either door, pull outwards on the door release handle at the edge of the door to release the door-open latch, and swing the door into the closed position; as the door enters its frame, the up-latch is released, the door is guided down to engage the sets of lugs, and the safety latch engages automatically. When the safety latch engages, a yellow/black indicator flag appears behind an aperture in the furnishing panel. Before closing the port door the forward airstair must be stowed. (510; the folding step must be stowed; this step can be extended below the port door sill by operating a lever behind the panel labelled 'Airstep' above the port galley unit.)

A stowage for a self-inflating escape slide is provided on the inside face of the Service door, (both doors on 400, 510 and 539 aircraft). When the door is opened with the slide snap-hook engaged with the floor attachement point, the slide is released from the stowage. The slide is

cont/...

inflated by compressed air, and a gauge showing pressure is visible through a window in the stowage. The gauge should indicate in the green sector. The slide is prevented from inflating if the door is opened from the outside while the hook is engaged, but will still be released from it's stowage.

If either door becomes unlocked in flight, it is held in place by the pressure differential holding the door lugs against the matching frame lugs.

Rear Passenger Door. The rear passenger door in the pressure bulkhead aft of the toilets is opened by pushing the handle down and then swinging the door into the recess in the starboard toilet wall, where a spring-loaded catch in the floor holds it open. The catch is released by pressing on a tread-plate and the door can then be closed. Once closed, it is locked by returning the handle to the horizontal; a safety plate prevents the latches from being extended until the door has been fully closed.

Ventral Door. The ventral door comprises a door hinged at its forward end, integral steps, folding handrails and hinged bogie to compensate for varying ground attitude. The door is opened by pulling the interior handle out and turning it to 'Open', or by pulling the external handle down; this action opens the mechanical door lock, allowing the door to fall down against the damping action of a hydraulic jack. Neither handle will operate unless the other handle is in the stowed position.

To close the door from the inside, pull the operating handle from the stowed position and turn clockwise; this opens the hydraulic control valve to admit No.2 system pressure to the door jack, and closes a switch in the DC pump motor circuit. If No.2 system is already pressurised by the main or auxiliary pump, the door will be raised to the closed position.

(Not 400) (If No.2 system was depressurised the DC pump motor will not run unless the adjacent Air Stair Control switch is held up to 'Raise': the switch should not be released to 'Off' until the door is locked up.)

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To close the door from outside:
Do not attempt to raise the door by lifting the bogie.

1. Pull down the external operating handle, and lift the door to the closed position: the handle will return to the stowed position as the Up lock engages.

2. Check that the bogie folds to the stowed position as the door comes up.

Except on 400 and 501 aircraft and provided No.2 system is not pressurised, the door can be raised by:

1. check the external handle is in the stowed position.
2. Select the internal handle to 'Raise'.
3. Press the Airstair Control switch by the external handle (510 on the external APU control panel) up to 'Raise', and hold to 'Raise' until the door is closed.

FREIGHT DOORS A freight door is unlocked by pulling out the handle and turning it in the direction indicated, then pushing in the top edge of the door and allowing it to slide down under the restraint of the damper, until it reaches the stowed position below the fuselage, clear of the loading aperture. It is closed by disengaging the forward hook, lifting the door to engage the carrier rollers with the door frame tracks, pulling it up and out to the closed postion, and then locking it by turning the handle clockwise. When the door is locked the handle is returned to its recess by spring action, and an indicator bearing two black diagonal lines is visible in an aperture near each of the two bolts. A second handle is fitted to the inner face of the door to enable it to be opened from within the hold, if necessary.

HATCHES Pressurised hatches on the underside of the fuselage give access to the electrical and radio bays (400 - electrical bay only). Each is locked and unlocked by a handle at its centre and when unlocked, can be pushed in, tilted, and withdrawn from the fuselage.

DOOR SEALING The forward and rear passenger doors, service door and freight doors are surrounded by sealing tubes which are inflated by cabin pressure. Non-inflatable seals are fitted to the ventral door and radio and electrical bay hatches.

AIR STAIR CONTROL SWITCHES (2), one adjacent to the internal control handle for the ventral door, one by the external handle (510 - on the external APU Control Panel). Spring-loaded to centre 'Off', press up to 'Raise'. Both switches are inserted in parallel to the DC Pump motor circuit; pressing either switch to 'Raise' will complete the circuit through the switch operated by the internal door control handle, energising the DC pump motor when the internal handle is moved to 'Raise'.

(400) (There are no control switches. The DC pump runs whenever the internal handle is moved to raise. From outside the door must be raised manually)

(501) (There is no external control switch. From outside the door must be raised manually)

DOOR WARNING LAMPS (4), red, on left roof panel. Four double lamps, marked 'Front pass - Rear pass', 'Front Cargo - Rear Cargo', 'Service-Radio Bay', and 'Ventral' - Electric Bay', the appropriate lamp coming on when a door is not properly closed.

(400 Only) (There are three double filament lamps. There are no indications for Radio or Electric Bays)

The lamps are operated by microswitches at each door and hatch, the forward passenger and service door lamps in conjuction with the individual Door Locked lamps. A press-to-test button beside the lamps enables the serviceability of the filaments to be checked.

DOOR LOCKED LAMPS (2), green on forward doors. A double lamp, marked 'Butt' and 'Hook', is carried on each door, operating in conjunction with the red door warning lamp. When the door is correctly seated, the butt lamp will come on. When the door safety hook has engaged, the hook lamp will come on. When both lamps come on the associated Door Warning lamp will go out; it will subsequently come again if either butt or hook lamp goes out.

VENTRAL DOOR WARNING LAMP (1), amber, beside interior selector handle. Marked 'Airsteps door unlocked', comes on when either the door uplock is disengaged or the selector handle is not in the stowed position.

STEWARD'S CONTROL PANEL L, forward galley, port unit. Carries light switches, cabin address controls, and call lights, etc.

STEWARD'S CONTROL PANEL LA, rear vestibule. Carries light switches, call lights and (400 & 510 only) - cabin address controls.

GALLEY CIRCUIT BREAKER PANELS (3), at each galley unit. Carry circuit breakers and switches for galley electrical equipment.

FORWARD AIRSTAIR CONTROL LEVER (1), behind inward-opening panel in forward port bulkhead of front vestibule. The forward airstair is normally stowed across the fuselage under the forward vestibule floor. Before operating the airstair, the port passenger door must be latched in the fully open postion. The operating lever also controls the DC pump to provide hydraulic system pressure to the actuating jack; if No.2 system is pressurised, the DC pump is automatically isolated.

(Not 510)

Moving the lever to the left (outboard) extends the airstair from the stowed position, and then allows them to drop by gravity, the jack acting as a damper. Move the lever to the right (inboard) to raise and stow the airstair.

The handrails are raised and lowered by a mechanical linkage with the airstair. The airstairs are mechanically locked in the stowed position, the lock operated by the control lever.

(510 Only) (Ther are no forward airstairs fitted. The handle moves a single step unit which covers the space where the airstairs should have been)

EMERGENCY WINDOWS. (4), two on either side of the passenger cabin. (400 - (2), one on either side) Inward opening, retained in position by two spigots at the bottom and a catch at the top. To release the window , either press in the red button on the outside of the fuselage at the top of the hatch, or pull the red handle on the inside window frame. Tilt the frame inward to clear the hatchway then throw out through the opening.

ENTRANCE LAMPS. Lamps illuminating the forward passenger doorway step and the service doorway are controlled by switches on steward's panel L; that for the service door lamp has 'Off', 'Dim' and 'Bright' selections. Lamps above the ventral stairway and in the tailcone are controlled by a switch on steward's panel LA.

CABIN LAMPS. A rotary switch on steward's panel L controls fluorescent tubes in cabin and vestibule roof fittings in the 'Bright' position, and filament lamps in the same fittings in the 'Dim' position. If the AC supply should fail when the switch is at 'Bright', the dim lighting will automatically be energised.

READING LAMPS. Pre-set lamps in the passenger services units serve each seat; they are controlled by adjacent push-button switches.

TOILET LAMPS. Each toilet is lit by fluorescent tubes, two of which are permanently on, while the other four are lit when the door is bolted.

TOILET NOTICE. An illuminated 'Toilets Engaged' notice is fitted in the roof by the toilets, 'Toilets' being permanently lit, whereas 'Engaged' is lit only when the toilet doors are bolted.

NOTE -When a 200/115V external supply is connected and the ground power CB is tripped, the cabin and toilet fluorescent lamps are lit, by-passing the switches. In addition, the hold lamps switches are connected to the ground power TRU.

NO SMOKING and FASTEN BELT NOTICES are fitted either side of the cabin in the base of the overhead racks, (400, 510 and 539:- in the roof at the forward end and at the centre of the cabin,) with warning lights on the steward's control panels L and LA, and are controlled by switches on the centre roof panel. When the 'Fasten Seat Belts' switch is set to 'On', the system 1 emergency lights are energised.

The galley chimes give audible warning when either notice is switched on. RETURN TO SEAT notices are fitted in the toilets and are controlled by the 'Fasten Seat Belts' switch.

CREW CALL LAMPS (2), green, on steward's control panels L and LA. Operated by the Steward Call button on the centre roof panel, which operates the chimes in the

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pantries at the same time. When the flight deck is called from the cabin, the blue lamp in the Steward Call button lights, and a chime sounds in the port console.

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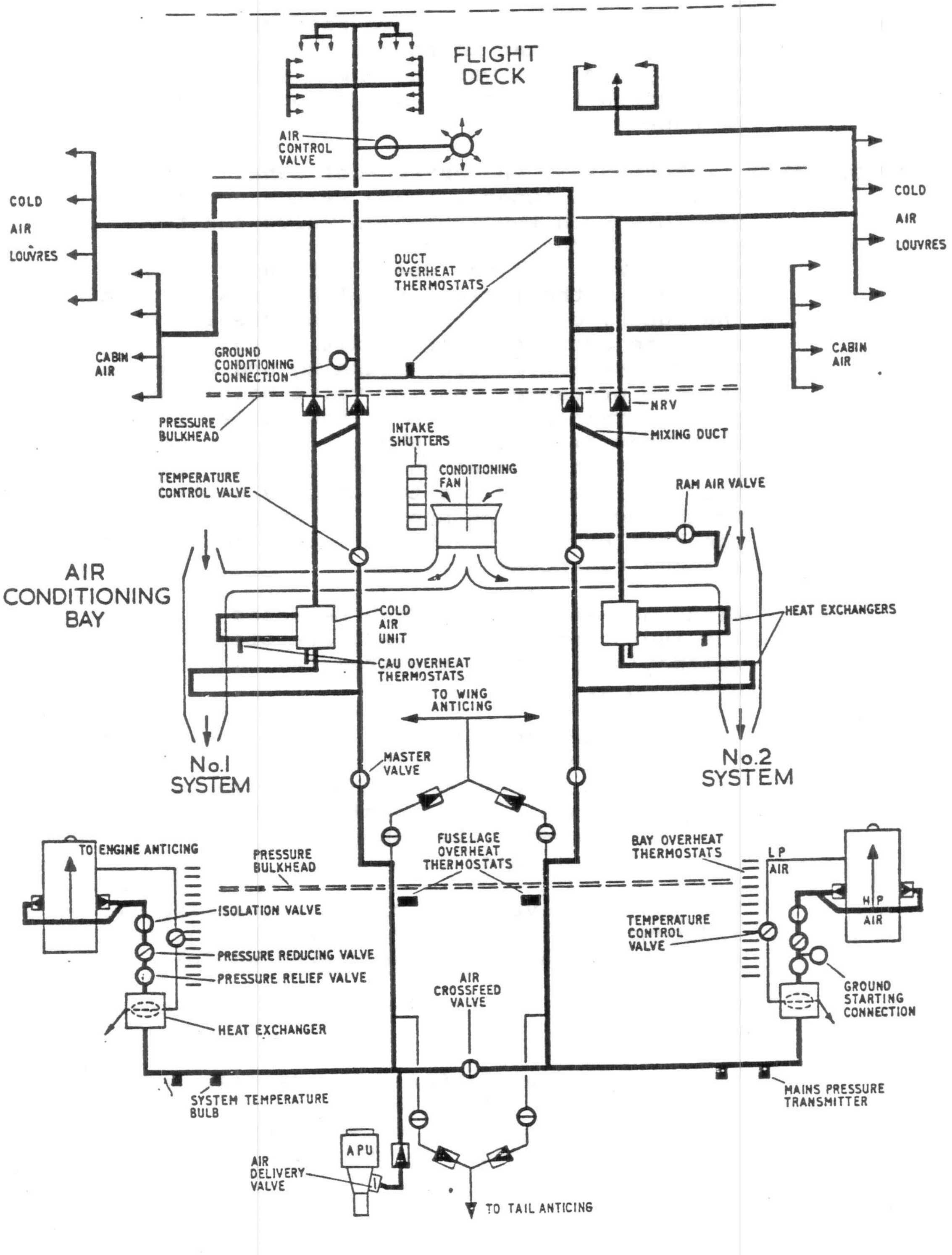
AIR SYSTEM


FLIGHT DECK
AIR CONTROL VALVE
COLD AIR LOUVRES
COLD AIR LOUVRES
DUCT OVERHEAT THERMOSTATS
CABIN AIR
CABIN AIR
GROUND CONDITIONING CONNECTION
PRESSURE BULKHEAD
NRV
MIXING DUCT
INTAKE SHUTTERS
CONDITIONING FAN
TEMPERATURE CONTROL VALVE
RAM AIR VALVE
AIR CONDITIONING BAY
COLD AIR UNIT
HEAT EXCHANGERS
CAU OVERHEAT THERMOSTATS
TO WING ANTICING
No.1 SYSTEM
MASTER VALVE
No.2 SYSTEM
TO ENGINE ANTICING
PRESSURE BULKHEAD
FUSELAGE OVERHEAT THERMOSTATS
BAY OVERHEAT THERMOSTATS
LP AIR
HP AIR
ISOLATION VALVE
PRESSURE REDUCING VALVE
PRESSURE RELIEF VALVE
TEMPERATURE CONTROL VALVE
AIR CROSSFEED VALVE
GROUND STARTING CONNECTION
HEAT EXCHANGER
SYSTEM TEMPERATURE BULB
MAINS PRESSURE TRANSMITTER
APU
AIR DELIVERY VALVE
TO TAIL ANTICING

AIR SUPPLY

FAIL WARNING LAMPS (2), amber, on centre roof panel. One for each system, giving warning of a failure resulting in excessive temperature or pressure.
(510 only) (Connected to the amber MWS)

FUSE DUCT FAIL TEST BUTTON (1), on centre roof panel. If fuselage overheat thermostats are serviceable, both system Fail warning lamps will light when the button is pressed, and go out when it is released.

ISOLATION VALVE SWITCHES (2), on centre roof panel. Marked 'Close', and 'Open'. Each switch normally controls both the isolation valve and the pressure reducing valve in its air supply system. When set to 'Open' with air pressure available, the isolation valve opens to permit the supply of HP bleed air from the engine for airframe anticing, air conditioning, pressurisation, toilet flushing and water tank, and the pressure reducing valve maintains a pre-determined pressure at the outlet from the main heat exchanger. When at the closed position, the isolation and pressure reducing valves close, and the temperature control valve which regulates the supply of engine LP air to the heat exchanger is also closed to prevent wastage of engine air.

With the associated switch selected to open, the isolation valve and PRV are closed automatically and the system fail warning lamp comes on if:

1. System air pressure or temperature becomes excessive.
2. A stub wing overheat is sensed.
3. An air conditioning overheat is sensed (the appropriate master valve will also close).

The isolation valve is closed automatically, independently of the PRV, by operating the fire control handle of the associated engine.

The PRV operates independently of the isolation valve when:

1. System master valve is selected to APU - PRV closes.
2. Engine Start or Motor cycle is initiated - PRV opens fully.

FAIL PRESS TO RESET BUTTONS (2), on centre roof panel. Used to reset the system and extinguish the Fail lamp after pressing the Stub Duct Fail Test button and after an air system failure.

STUB DUCT FAIL TEST BUTTONS (2), on centre roof panel. If the stub fairing bay overheat thermostats are serviceable the System Fail warning lamp will light when the button is pressed, remaining on when the button is released.

AIR X-FEED VALVE MAGNETIC INDICATOR (1), on centre roof panel. Shows cross-hatch when no electrical supply, 'Open', or 'Closed'.

AIR X-FEED VALVE SWITCH (1), on centre roof panel. Marked 'Close' and 'Open'. When at 'Open' a solenoid is energised, allowing air pressure from either side to open the valve, thus interconnecting the two systems. The valve will close automatically in the event of overheating in either air conditioning system.

AIR DEL VALVE SWITCH (1), on centre roof panel. Marked 'Close' and 'Open'. Controls the air delivery valve which allows the APU to supply air to No.1 system on reaching 95% of operating rpm. The valve regulates the airflow so as to prevent overheating of the APU, and will close automatically in the event of overheating in No.1 air conditioning system.

MAINS TEMP GAUGE (1) on anticing section of roof panel (centre roof panel on the 510). A dual gauge showing the temperature of each system upstream of the Master Valves.
(Not 400)

(Some 400 aircraft have a dual switch to allow the antice temp gauge to fulfill this function)

DUCT PRESSURE GAUGE (1), on centre roof panel. A dual gauge, showing the inlet pressure of each system, upstream of the Master Valves.

AIR CONDITIONING

MASTER VALVE WARNING LAMPS (2), amber, on centre roof panel. A lamp comes on, and its associated valve closes, as a result of excessive air temperature in the system.
(510 only) (Connected to the amber MWS)

MASTER VALVE SWITCHES (2), on centre roof panel. Rotary, left 'Close', centre 'APU', right 'Open'. When set to 'Open' with air pressure available, the valve maintains a constant mass flow to the air conditioning system; when set to 'APU' the valve regulates the mass flow, and also the pressure reducing valve closes, allowing the system to be supplied with air from the APU instead of from the engine.

When set to 'Close' a bleed valve upstream of the master valve prevents the pressure in the ducting from rising far enough to operate the pressure override.

Both valves will close and their warning lamps will light when the conditioning fan isolation switch on electrical panel B has been set to 'Isolate'. (On the 400 series a/c BBME and BBMF the valves will close but the lamps will not light)

RAM AIR SWITCH (1), on centre inst panel.(Centre roof panel on 510) Lock-toggle switch, up 'Close'(Normal on 510), down 'Open'. When set to 'Open' the ram air valve opens in a duct between the starboard (No.2) cooling air intake and the mixing duct downstream of the temperature control valve, allowing outside air to ventilate the aircraft during unpressurised flight. When the switch is at 'Close/Normal' the valve is closed.

TEMP VALVE POSITION INDICATORS (2), on centre roof panel, marked 'Cold-Inter-Hot'. One for flight deck, one for cabin. Show the settings of the temperature control valves at any time.

TEMPERATURE CONTROL SWITCHES (2), on centre roof panel, for flight deck and cabin. Down 'Auto', left 'Dec', right 'Inc'. centre off; spring-loaded to off from 'Dec' and 'Inc'. Each switch adjusts the position of its associated temperature control valves to vary the temperature of the conditioned air by changing

cont/...

the proportion of the hot air supply which passes through the valve to the air mixing duct, the remainder going to the air mixing duct through the refrigeration system.

When at 'Auto', the temperature control valve is regulated by a temperature controller with its sensor in the flight deck or cabin, according to the datum temperature set by the Temperature Selector. The 'Inc' and 'Dec' positions enable the setting of the temperature control valve to be regulated manually; a high limit switch prevents the valve from being opened too far during manual control.

TEMPERATURE SELECTORS (2), on centre roof panel, one for flight deck, one for cabin. Infinitely variable over the range marked 'Cooler-Normal-Warmer'. Each selector varies the datum about which the temperature controller regulates the temperature control valve.

CABIN TEMPERATURE GAUGE (1), on centre roof panel. Operated by a temperature bulb in the cabin.

AIR INLET TEMP GAUGE (1) on centre roof panel. A dual gauge showing temperature of air entering Flt deck/Passenger Cabin.
(Not 510)

AIR CYCLE INLET/OUTLET TEMP GAUGE (1), on electrical panel B.

SYSTEM 1/2 SELECTOR SWITCH. The gauge shows the temperature of the air entering and leaving the cold air unit of the system to which the switch is selected.
(Not 400/510)

COOLING FAN ISOLATE SWITCH (1), on electrical panel B. (Port console on the 510) Lock-toggle switch, up 'Isolate', down 'Normal'. When at 'Normal' the fan automatically provides cooling air for the heat exchangers at low airspeeds with the undercarriage down, and on the ground. Once started, the fan will keep running regardless of airspeed 'until the undercarriage is raised, its circuit breaker is pulled, or No.2 auxiliary hydraulic pump is switched on.

When the switch is set to 'Isolate', the fan is disconnected from its electrical supply and both Master Valves are isolated from their

cont/...

switches so that they close to prevent overheating of the system; except on 400 series a/c BBME and BBMF the Master Valve warning lamps light to indicate this. In flight, the fan should be running when the IAS is 165 kt or less.

If the cooling fan motor overheats, a latching relay will cut the electrical supply to the motor and the FAN MI, (if fitted), will display Fail; the relay can only be reset when the motor has cooled, by selecting the Isolate switch to Isolate and then returning it to Normal, and the MI, (if fitted), will display Green as soon as a reset is achieved.

COOLING FAN MI (Not 400/510) (1), on centre roof panel. Displays Black (no electrical power), Green (normal), White FAIL on red background (fan motor overheat).

FAN INTAKE SWITCH (Not 400) (1), on electrical panel B. (Port console on the 510) Up 'Shut', down 'Auto'. When at 'Auto', the shutters over the cooling fan intake in the underwing fairing are controlled by undercarriage microswitches to open when the weight is on the undercarriage. When at 'Shut' the automatic control of the shutters is overridden. Air conditioning may be used with the shutters failed or selected 'Shut', but the cabin may become excessively warm in high ambient temperatures.

AIR CONTROL VALVE (1), in flight deck roof. Marked 'Increase-Decrease', controls the supply of conditioned air through the overhead diffuser.

INDIVIDUAL LOUVRES. Cool air is supplied to individually-adjustable outlets in the flight deck, passenger cabin, pantries and toilets from tappings downstream of the cold air units.

TOILET EXHAUST FAN, controlled by a circuit breaker on panel B, extracts stale air from the toilets. (CB will be identified by an orange/red fluorescent marker).

PRESSURISATION

CABIN SELECTOR (1), on centre instrument panel. Centre knob rotates pointer to the required barometric pressure on the scales on the dial to provide a datum at which the desired cabin altitude is set by means of the knob marked 'A'. The rate of change of cabin altitude is set by the knob marked 'R', the normal setting being with the white spot uppermost.

In combination with the amplifier pack, the Cabin Selector regulates the supply of control air to the pneumatic actuator which adjusts the setting of the discharge valve so as to regulate the cabin differential pressure and the rate of change of cabin altitude.

If it is necessary to obtain an accurate cabin altitude, set 1013 mb on the barometric scale.

CABIN RATE-OF-CLIMB INDICATOR (1), on centre instrument panel. Indicates rate of change of cabin pressure as a rate of climb or descent in feet per minute.

CABIN ALTIMETER (1), on centre instrument panel. Indicates the cabin pressure in feet of altitude, and cabin differential pressure.

CABIN ALTITUDE WARNING LAMP (1), red, on centre instrument panel, connected to the master warning system. When the cabin altitude exceeds a pre-determined value a pressure-operated switch causes the lamp to light.

SAFETY VALVE SWITCH (1), on centre instrument panel.(Centre roof panel on the 510) A lock-toggle switch, up 'Close'(Normal on the 510), down 'Open'. Controls the operation of the combined safety/inwards relief valve. Normally at 'Open' before starting engines to minimise pressure surges on initiation of airflow, 'Close/Normal' after starting, when the valve functions automatically as a safety valve or an inwards relief valve as necessary. Should the safety valve's main servo valve fail 'open', its reserve servo valve will then operate to maintain a safe cabin differential pressure.

DISCHARGE VALVE POSITION INDICATOR (1), on starboard console. Shows the setting of the discharge valve at all times; used in conjunction with the adjacent Air Dump Valve control.

Actual setting of the dump valve is shown by a pointer moving over a scale reading from 'Close' to 'Open'.

AIR DUMP VALVE CONTROL (1), on starboard console. This control may be used to open or close manually the discharge valve. The control is extremely sensitive and only a small amount of movement is required to achieve the desired result.

To open the Discharge Valve:

1. Press control knob down to disengage dog-clutch.
2. Turn control knob slowly clockwise, monitoring the cabin ROC indication.

To close the Discharge Valve:

1. Press control knob down to disengage dog-clutch.
2. Turn knob slowly clockwise until cabin ROC indicator shows increased rate of climb.
3. Trip CB B56 (colour-coded green). (B53 on 400 & 510)
4. Turn knob slowly anti-clockwise, monitoring cabin ROC indication.

NOTE: If knob is turned anti-clockwise without tripping the CB, the discharge valve can close only as far as the pressure controller permits.

OXYGEN SYSTEM
AIRCRAFT WITH DROP-OUT FLIGHT DECK OXYGEN
(501,510,515,530)

OXYGEN CONTENTS GAUGE (1), on starboard console.

(501/515/530) Marked 0-2000psi.

(510) Two sectors, yellow and green. When the pointer is in the green sector the system is at least nine-tenths full. The '3/4 full' position is indicated by a red mark, and this is the minimum acceptable quantity for normal pressurised flight.

OXYGEN SUPPLY VALVE (1), on starboard console. When open allows oxygen to flow from the storage cylinder in the equipment bay to the double pressure regulator, provided that the valve in the head of the cylinder is open. (Normally wire-locked).

OXYGEN OVERRIDE CONTROL (1), at top of centre instrument panel. A barometric controller acts in conjunction with the double pressure regulator to control the pressure of the supply. If the cabin altitude rises above a certain figure the barometric controller causes the regulated pressure to increase and the override control to protrude. If required, the higher pressure can be obtained at any time by pulling the override control.

When the cabin altitude falls again, the barometric controller can be reset by pushing in the override control, whereupon the supply pressure will return to normal.

PASSENGER OXYGEN VALVE (1), on starboard console. Isolates the passenger supply system from the remainder of the system.

(510) Turn clockwise to close

(501/515/530) Pull to close

HOOTER KNOB (1), on starboard console. When rotated to Cancel silences the warning hooter which sounds when its barometric controller senses an excessive cabin altitude.
(510 only)

RING MAIN PRESSURE OXYGEN GAUGE (1), on starboard console. Two sectors, marked 'Norm'(green) and

cont/...

'Emergency' (red). Indicates which pressure is present in the system downstream of the double pressure regulator.

Crew Supply:

The crew main supplies three mask stowages in the flight deck roof. The masks have integral microphones and each can be released at will by pulling a red knob on the stowage. They will be released automatically when the supply pressure rises to the higher value, whether this is caused by the barometric control or by the manual override control. A self-sealing socket at each stowage provides for the connection of a smoke mask.

(501/515/530) (There is an additional therapeutic outlet connected to the crew supply for the occupant of the second jump seat)

continued on page 2-13

OXYGEN SYSTEM
AIRCRAFT WITHOUT DROP OUT FLIGHT DECK OXYGEN
(400,523,528,539)

OXYGEN CONTENTS GAUGES (2) on starboard console, show pressure in main oxygen storage cylinders, Fwd gauge - flight deck cylinder, aft gauge passenger supply cylinder. Both cylinders are charged to 1,800 psi from a common charging connection.

OXYGEN SUPPLY VALVES (2) on starboard console. The fwd valve controls the supply of oxygen to the flight deck system, the aft valve the passenger supply. The cylinders are interconnected down stream from the valves, a non-return valve ensuring that the contents of the smaller (flight deck) cylinder cannot feed into the passenger system, whilst allowing the larger cylinder to augment flight deck supplies. Turn anti-clockwise to open valve, clockwise to close. The pressure in the passenger ring main is regulated to 40 psi, in the crew main to 70 psi.

DEMAND REGULATORS (3) on flight deck roof, port and stbd consoles. Each regulator comprises an On/Off supply switch, Emerg On/Off guarded switch, Oxygen 100% switch, and flow indicator. With normal On selected, oxygen-enriched cabin air

cont/...

is supplied via a hose and mask normally connected to the regulator. Selecting 100% on gives a supply of pure oxygen to the mask. With Emerg selected and the supply switch On, the supply of pure oxygen is increased.

Passenger Supply:

Self-sealing sockets on eighteen of the passenger services units (19 on the 510) permit oxygen to be drawn when both the Oxygen Supply and Passenger Oxygen valves are open. The masks for use with these sockets are carried in a cupboard aft of the port toilet.

(501/515/523 528/530 only) One passenger oxygen mask is fitted with an extended hose, to be used to supply oxygen from the supply point above seat row 18 starboard to passengers in seat row 20; this mask can be identified by the green band on the hose near the connector, and by an orange band around the plastic bag in which it is packed.

SMOKE MASK (1), in stowage on port console. Except on the 510 it is connected to the 310 litre oxygen cylinder which is carried at the rear end of the port console. The oxygen supply must be connected and flowing before the mask is put on.

(510 only) (A second mask is stowed on the bulkhead behind P2's seat. Either mask may be connected to the self-sealing sockets on the drop-out mask stowages, when, in addition to oxygen being supplied, the microphones in the masks will be connected and will, in conjunction with the headset earphones, permit normal intercom and R/T communication. Alternatively one mask may be connected to the 310 litre oxygen cylinder.)

A speech diaphragm in each mask may be used for person-to-person communication, and also permits normal intercom and R/T communication when the headset microphone is placed over it.

SMOKE HOODS (3), one on the flight deck, two in the cabin. The smoke hood is contained in a plastic box, within a sealed plastic bag. Each assembly comprises a flexible, fire-resistant hood, fitted with a transparent visor, neck seal, and a pack containing a chemical generator and CO2 scrubber.

When the hood is worn, the generator/scrubber pack is carried at the back of the neck, attached to the hood by press-studs, with a cowl to dissipate the heat produced within the pack. To start oxygen flowing, pull the ring-ended firing pin on the side of the pack.

cont/...

The pack will produce oxygen at a rate of approx 5 litres/minute, discharged into the hood across the visor, the venturi action of the nozzle inducing recirculation of exhaled air through the CO2 scrubber and back into the hood for reuse.

The internal oxygen/air pressure is regulated to very slightly above ambient pressure, and a relief valve discharges oxygen to atmosphere if the supply pressure exceeds 20 psi.

The pack duration is 15 minutes.

PORTABLE OXYGEN SETS (4), two below forward cabin crew seat, one on cabin port rear bulkhead and one inside the flight deck door. Each set comprises a cylinder and a mask, the cylinder having a rotary control marked 'Open-Closed', a contents gauge, and two bayonet outlet connections. Oxygen flows only when the mask is connected to one of the oulets.

Pressure reducing valves maintain a 70 psi supply to the regulators.

When oxygen is flowing to the mask, a white pellet is visible in the flow indicator window.

PASSENGER SUPPLY CONTROL PANEL (1), on starboard console,(roof panel on 400), comprising:
(Not 539)

OXY RING PRESS GAUGE. With the passenger (aft) supply valve open, oxygen is supplied via a duple pressure regulator at 40 psi to the ring shut-off valve. Normal green sector from 35-45 psi, emergency red sector from 85-95 psi.
(Not 539)

THERAPEUTIC SUPPLY CONTROL VALVE KNOB, green. When the knob is pulled, the passenger cabin ring main is pressurised at 40 psi, and spare masks can be plugged in via self-sealing outlets on 18 of the passenger service units. (All the PSUs on the 400)
(Not 539)

To shut the control valve, press the knob fully in to release trapped pressure in the ring main, release, and check that the knob remains in. The knob may be operated automatically by the cabin altitude warning system. Each supply outlet can be controlled to high (4 litres/minute) or low (2 litres/minute) rate of flow.

RING MAIN HP INDICATOR LAMP (1). If cabin altitude exceeds 14,500 +/-500psi, a barometric capsule will operate the duple pressure regulator to increase ring main supply pressure to 90 psi. As pressure rises, the therapeutic supply valve will open automatically and the knob will spring out. A 54 psi switch puts on the cabin notices and the HP indicator lamp.
(Not 539)

Provided that cabin altitude does not exceed 17,000ft, the ring main pressure is reduced to the normal 40 psi within 30 seconds; if cabin altitude exceeds 17,000ft, the flow rate will remain at the emergency 90 psi until the cabin altitude falls below 17,000ft.

cont/...

When cabin altitude is below 14,000 ft, and therapeutic oxygen is no longer required, the supply valve knob should be pressed in.
As ring main pressure falls below about 25 psi, the cabin notices will be released, and the

indicator lamp go out.

(523/528 only) (There is an additional therapeutic supply for the occupant of the second jump seat, attached to the passenger supply system)

MANUAL OVERRIDE KNOB, red. If the automatic system fails to operate during a cabin decompression, pulling the knob will manually control the duple pressure reducing valve to 90 psi. Pressing the knob fully in will cancel the override, and restore the system to automatic operation.

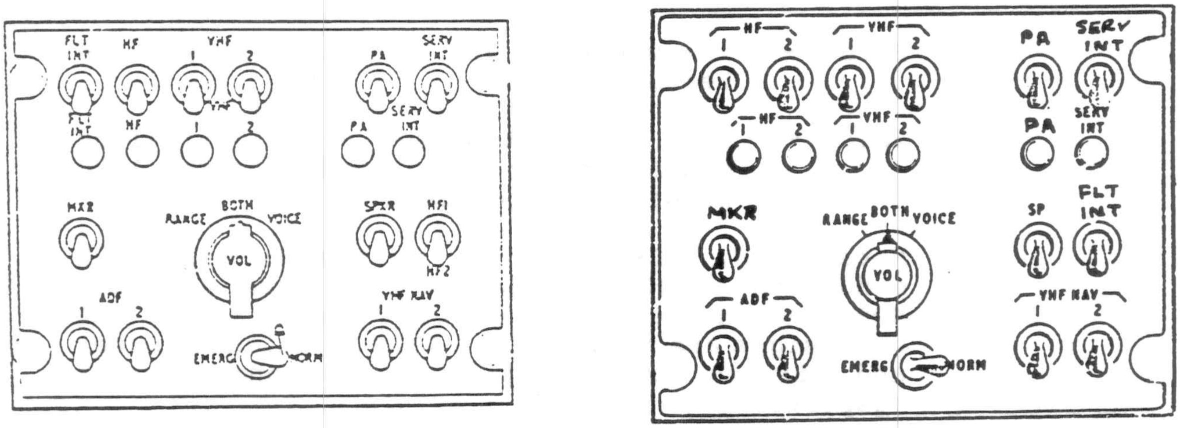
(Not 539)

COMMUNICATIONS CONTROL SYSTEM

GENERAL. The Bendix LA17BT Communications Control System (CCS) provides:

- Selection of receiver audio output -
- Selection of communication transmitters -
- Use of Cabin Address system -
- Intercom between:
    - Flight deck stations -
    - Flight deck and galleys -
    - Flight deck and ground -
    - Forward and aft galleys -
    - Service jack boxes.

Reliability is improved by segregation of flight deck and cabin/ground intercom circuits so that the latter cannot interfere with the former.



515/523/528/539

400/501/530

STATION BOX

STATION BOX (3) These are mounted on the port and starboard consoles and on panel R and carry the following controls.

Audio Selector Switches. These toggle switches, titled as shown, allow selection of those systems' audio outputs. In normal conditions there is no limit to the number of systems that may be selected.

(515/523/528/539 only) (The HF switch in the top row connects whichever is selected at the HF1/HF2 switch in the middle row. As only one HF Coms system is carried, the latter switch must remain at HF1.)

Transmitter Selectors. The row of push button switches associated with the top row of audio selector switches connect the user's microphone to the selected system. Apart from the Flt Int button, where fitted, only one other may be selected at any time; pressing another releases the first. To release a button without selecting another, any other button must be partly pressed in. The button is lit when depressed.

The appropriate button must be pressed and the transmit switch set to R/T (or PTT) to use PA or Service Intercom.

Range-Both-Voice switch. For use when ADF is selected, filters are connected as follows:

Range - all frequencies except 1020 Hz are attenuated so only NDB call- signs and anything else modulated at 1020 Hz will be heard.

Both - the whole of any audio signal will be heard.

Voice - 1020 Hz is attenuated so NDB call-signs and any other signal modulated at 1020 Hz will not be heard.

Note: NDB, VOR and ILS call-signs are all modulated at 1020 Hz except for some American NDB's which have 400 Hz call-signs. All DME call-signs are modulated at 1350 Hz; middle, outer and airways markers at 1300, 400 and 3000 Hz respectively.

Volume Control. This controls the Station Box output level of the receiver(s) selected, and the intercom side-tone level.

Emerg - Norm switch. A station box failure can cause loss of all signals. Selecting Emerg allows reception of one receiver output only. If more are selected they will be heard at other station boxes although not selected there. Intercom is not available at that box.

Spkr switch. P1 and P2 station boxes each have an associated loudspeaker, mounted above the port and starboard windscreens and controlled by this switch, on which the selected audio output may be heard. The speakers are inoperative whilst P1, P2 or P3 transmit/intercom switches are in use. The Spkr switch on P3 station box is inoperative, having no associated speaker.

Serv Int switch. Provided the Service Jack Boxes switch is on, this connects the station box to all the service intercom jack boxes and galley intercom.

SERVICE JACK BOXES ON-OFF SWITCH. At "OFF" this switch isolates all service jack boxes, except the nose position, from the service intercom amplifier. The nose position and cabin crew handsets are permanently connected to the service intercom amplifier.

(510 only) (The nose position is permanently connected to the flight deck intercom circuit. The cabin crew handsets are conncted to the flight deck intercom when 'Flight' is selected on the 'Flight/Pantry switch in the galley)

SERVICE JACK BOXES (6). These are mounted at the nose port side, refuelling panel, main wheel bay, each engine stub and at the tailplane bullet. (400 & 539 aircraft are lacking the tailplane bullet position)

TRANSMIT SWITCH (3). These are mounted one on each control column outer hand-grip and one on P3 panel below the Station Box on Panel R. P1 and P2 switches are marked R/T-OFF-I/C and are sprung from I/C to R/T; P3 switch is marked OFF-PTT and is sprung from PTT to OFF.

(510 & 400) (On all 510 aircraft and the 400 series aircraft AWBL there is an additional override position on the P1 and P2 switches, marked O/R, which allows the user to be heard at fill volume at all station boxes to the exclusion of other signals)

BOOM HEADSET SOCKET (3) These are mounted near the three station boxes and allow connection of a conventional boom microphone and telephone headset. There is also a facility for headsets alone, for use with a hand microphone. This is not utilised.

OXYGEN MASK MICROPHONES (3). These are integral with the masks and plugged into the socket on the oxygen mask panel.

(501/510/530) (The mask is automatically connected to the appropriate station box when the stowage cover of the drop-out box is released)

SMOKE MASK MICROPHONES (2) These are connected to the appropriate station box when the smoke mask is plugged into the socket on the drop out box
(510 only)

MIKE SELECTION SWITCHES (3). These have three selections Hand-Boom-Mask and must be set for the microphone in use. Mask refers to the oxygen mask microphone. The switches are near their station boxes.
(Not 501/ 510/530)

CABIN STAFF HANDSET PANELS (2). These are fully described in the Cabin Address System. The telephone handset provides intercom with the flight deck and between the galleys.

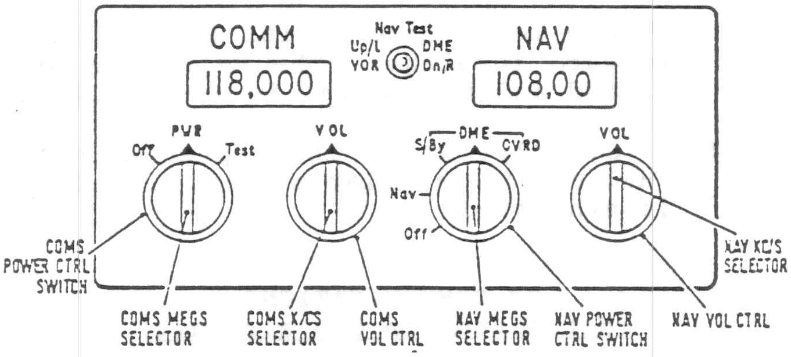
POWER SUPPLIES. These are shown in Chapter 5, Power Supplies. Intercom is available until the aircraft batteries are exhausted.

GROUND CALL LAMP Roof panel. Pressed to sound hooter in nose wheel bay.

FLIGHT DECK CALL SWITCH. Adjacent to the nose jack box. Sprung to 'Off', the switch lights the Ground Call lamp and sounds the chime in the port console.

VHF COMMUNICATIONS

GENERAL. Two complete installations form identical twin communication systems VHF1 and VHF2. (On 510 series aircraft provision is made for a third system but the units are not fitted.)



VHF COMM/NAV CONTROLLER

CONTROLLER (2). Two combined VHF Comm/Nav Controllers are mounted on the pedestal, VHF1 port, VHF2 starboard. The above diagram shows the controls and most of their functions. The Comm side of each Controller allows selection of 1440 25KHz paced channels within the band 116-151.975 MHz

The 'Test' position of the power control switch disables the squelch circuits of the receiver to enable operation to be checked in the absence of incoming signals; receiver noise would be heard if serviceable.

The Nav side of the Controller is featured in Radio Nav Systems.

TRANSCEIVER UNIT (2). Third shelf down, flight deck radio rack. This incorporates frequency synthesiser, receiver and transmitter circuits. The frequency synthesiser controls, with a single crystal, all 2880 receiver and transmitter frequencies. The receiver provides all the 1440 channels selectable at the controller. A squelch circuit cuts off all receiver noise when no readable signal is being received. The transmitter unit provides all the 1440 channels selectable at the controller. Output power is nominally 30 watts.

cont/...

A 'Squelch Disable' button, 'Power' meter and switch, microphone and headset sockets on the front of the unit are for maintenance purposes only.

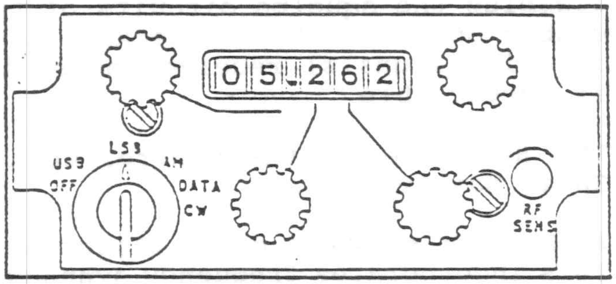
AERIALS (2). Mounted as follows:-
Tx/Rx 1 Mid lower fuselage
Tx/Rx 2 Tailplane bullet top

(510 only) (There is a third aerial for VHF3 on top of the forward fuselage. The third VHF system is not fitted and the aerial is not utilised)

POWER SUPPLIES. DC only, shown in Chapter 5 Power Supplies. VHF1 remains available until the aircraft battery is exhausted.

HF COMMUNICATIONS
(Not fitted to 510 aircraft)

GENERAL. A single Collins 618T-2 transceiver with a Collins 714E-3 controller provides HF R/T communications within the band 2 to 29.999 MHz using single or double side-band transmission. The system may be de-activated on some aircraft but can be restored to use at quite short notice.



HF CONTROLLER

CONTROLLER. Mounted on the pedestal, this has controls as shown above and detailed below;

Mode selector. The functions of the Mode Selector are;

Off - All power off.

cont/...

USB	- Power on, system in amplitude modulated single (upper) side-band mode. See reference to frequency stability below.
LSB	- Power on, system in amplitude modulated single (lower) side-band mode.
AM	-Power on, system in amplitude modulated double side-band mode.
DATA	- Inoperative.
CW	- Not used. If this is selected and the transmit switch operated to R/T, a CW signal 1 kHz above that shown on the tuning scale will be radiated.

Tuning Controls. The four tuning controls allow selection of 28000 1KHz spaced channels within the band 2-30 MHz. The white lines between controls and tuning scale show which knob controls which digit.

Whilst the aerial circuits are tuning, a 1 kHz note is heard; when this stops, tuning is complete. Maximum frequency stability is achieved 15 minutes from power on.

If the required frequency is already set when moving the Mode Selector away from Off, it should be de-tuned by 1 kHz and then reset.

RF Sens Control. Radio frequency sensitivity control is, in effect, the gain control.

TRANSCEIVER UNIT. This is carried in the flight deck radio rack.

AERIAL TUNING UNIT. This is carried in the forward cabin on the port hatrack.

AERIAL. This is a wire fixed between the tail and upper fuselage.

POWER SUPPLIES. 115V AC and 28V DC as shown in FCS & Radio Power Supplies & Cooling.

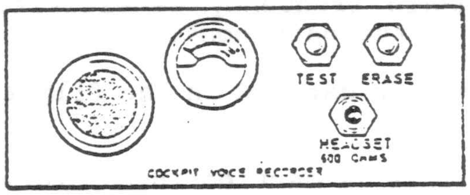
COCKPIT VOICE RECORDER

GENERAL. The Fairchild A100 Cockpit Voice Recorder records all that is said and heard by P1 and P2 via their Station Boxes, including radio navigation call-signs and signals as well as voices. It records also all that is said within range of P1 and P2 microphones without Station Box selection or use of a Transmit Switch, the microphones being always live with respect to the Recorder but. An area microphone on the Controller allows a recording of any other sounds such as warning bells, horns or voices heard on the Flight Deck.

Four separate channels recorded on a 4-track closed-loop tape of 30 minutes capacity allows simultaneous recording of;

P1 Station Box selection
P2 Station Box selection
P1 & 2 live microphones
Area microphone

An erase head cleans the tape before it reaches the recording heads so that only the last 30 minutes sounds are recorded. It is not possible to play back the tape in the aircraft. After landing, the whole recording may be erased or kept as required.



CVR CONTROLLER

CONTROLLER. Mounted in the starboard instrument panel, (centre console on 510, overhead panel on 515, 523 and 528). This has controls etc. as shown above and detailed below. The area microphone can be seen on the left.

Test button & meter. Press Test button for 5 seconds. The meter should read in the green 'Good' sector whilst the

cont/...

GPWS SYSTEM

On the above aircraft the GPWS system has no visual indications, only aural through the headsets. There is no 'pull up' indicator or G/S inhibit dolls-eye fitted.

There is instead a unit fitted on the centre console which incorporates a test/glideslope inhibit switch. In addition it has a flap normal/abnormal switch which, if selected to abnormal when landing with less than 26° of flap, removes the flap discreet from the system while not affecting the rest of the protection afforded by the GPWS.

There is also a switch which inhibits the complete system, which has the same effect as pulling the CB on the other aircraft.

button is depressed if all 4 channels are serviceable.

(510 only) (To test the CVR an HP cock must first be open)

Erase button. Operative only on the ground, pressing the Erase button for two seconds wipes the tape clean within ten seconds of releasing the button.

(510 only) (To erase the CVR an HP cock must first be open)

Headset socket. This allows a 600 Hz note to be heard on pressing the Test button if all four channels are serviceable. A 400 Hz note would be heard for 5 to 10 seconds after releasing the Erase button confirming that erasure is taking place.

The socket also allows monitoring of all recordings being made. The monitor output lags 1/4 of a second behind the original.

NOTE: NATO headset plugs will not fit the socket without an adapter.

VOICE RECORDER UNIT. This crash and fireproof unit is mounted in the rear starboard fuselage.

POWER SUPPLY. As shown in Chapter 5, Power Supplies.

GROUND PROXIMITY WARNING SYSTEM

GENERAL The Marconi-Lytton AD 2610 GPWS gives audio and/or visual warning of;

Mode 1 Excessive rate of descent with respect to terrain clearance.

Mode 2a - Excessive rate of closure with terrain, with less than 26o of flap selected.

Mode 2b - Excessive rate of closure with terrain in landing configuration.

Mode 3 Height loss after take-off or overshoot.

Mode 4a - Flight into terrain with less than 500 ft terrain clearance and undercarriage up.

Mode 4b - Flight into terrain with less than 500 ft terrain clearance and less than 26o of flap selected.

cont/...

Mode 5 - Excessive glidepath deviation. (No visual warning).

Modes 1 - 4 warnings have priority over Mode 5. The system is automatically inhibited during operation of the stall warning system. Manual inhibition is available for 'Glideslope' warning only. The complete system can be switched off only by tripping the GPWS circuit breaker.

NOTE: No warning can be given of approach to vertical terrain.

GPWS UNIT. Carried in the flight deck radio rack, this takes inputs of -

Radio height -
Barometric altitude rate -
Flap selector position -
Undercarriage selector position -
Glide path deviation.

These are constantly manipulated so as to detect entry of an aircraft into a situation requiring a warning, as shown by the hatched areas in Fig.1 - 6 on page 12. The unit then generates the audio and visual warnings.

AUDIO WARNING 'Pull Up' (Modes 1 - 4) This is given in the headphones and speaker in the form of a rising note sounded twice, WHOOP! WHOOP!, followed by the words 'Pull Up', the whole repeated continuously until the reason for the warning no longer exists. After three cycles, volume is reduced.

(400 & 510) (There is no speaker warning, only headphones)

AUDIO WARNING 'Glidepath' (Mode 5) This is a repeated warning in the headphones and speaker of the word 'Glideslope'. No visal warning is given.

(400 & 510) (There is no speaker warning, only headphones)

WARNING LAMPS. Two red, twin filament lamps marked 'GPWS Test' are mounted one in front of each pilot, on the edge of the glareshield, (539 - on the instrument panels), and have three functions.

Visual Warning. In the warning conditions, (modes 1 - 4) the lights flash continuously until the reason for the warning no longer exists. Whilst the lamps are lit the words 'Pull Up' are shown.

System Test. Pressing either warning lamp allows the system to be tested on the ground only. If

cont/...

it is serviceable, both warning lamps flash, the audio warning 'WHOOP, WHOOP, PULL UP, GLIDESLOPE' is given at reduced volume and the inhibit indicator cycles, after the lamp has been released.

Glidepath Warning Inhibition. Either lamp may be pressed to inhibit deviation warnings, provided the aircraft is above, or has been above 700R. The inhibit remains until either the warning lamp is pressed again or the aircraft goes below 100R or the aircraft overshoots below 700R.

(G/P) INDICATOR. (2) Mounted on the port and starboard instrument panels, this is a magnetic indicator which shows 'Inhib' whilst Mode 5 warnings are inhibited and 'Norm' otherwise.

BAROMETRIC RATE COMPUTER. Carried in the front equipment bay, this unit is supplied with static pressure and produces an output signal representing vertical speed.

POWER SUPPLIES. As shown in Chapter 5, Power Supplies single phase 115V AC and 28V DC. The AC circuit breaker on panel RB has an orange collar for identification to inhibit the system.

GPWS WARNING ENVELOPE

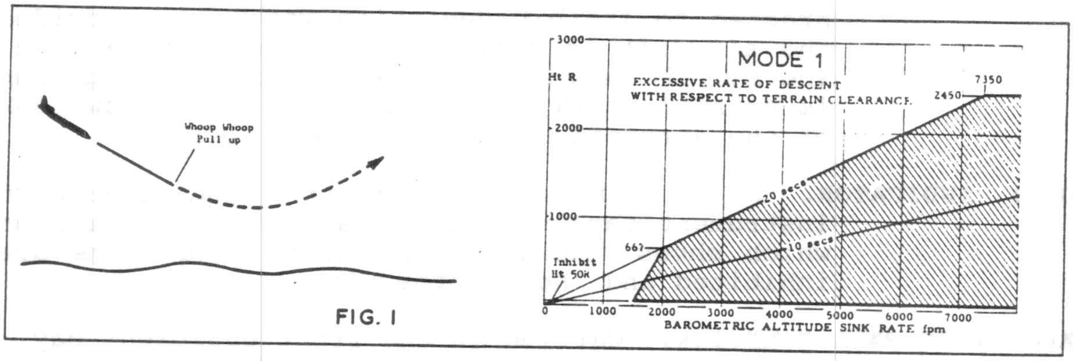


FIG. 1

THE 20, 15, 10 & 5 SECS
LINES SHOW THE TIME
LEFT BEFORE IMPACT
IF NO ACTION IS TAKEN

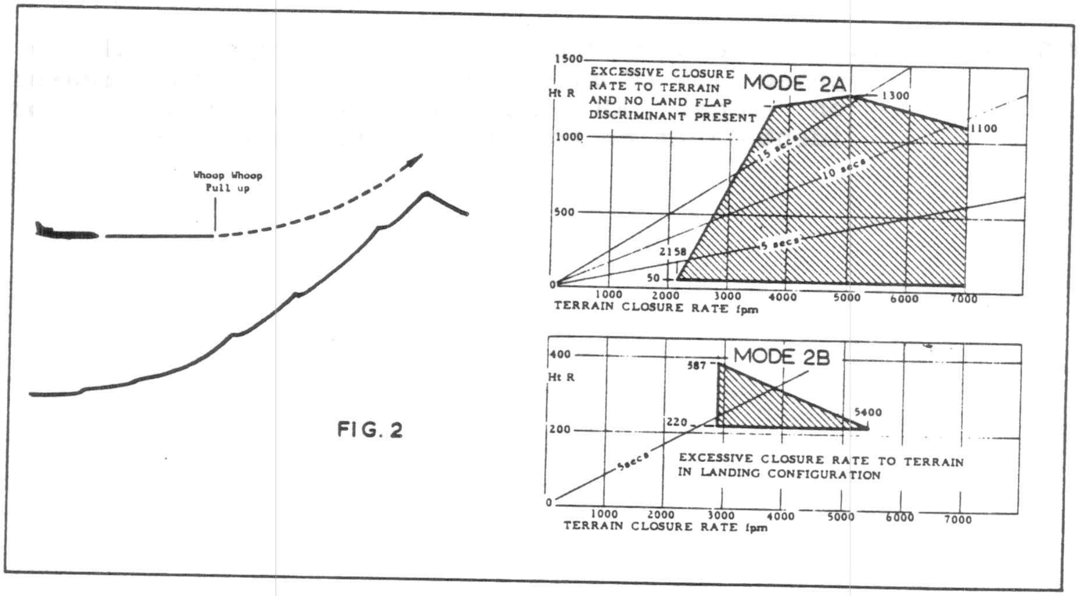


FIG. 2

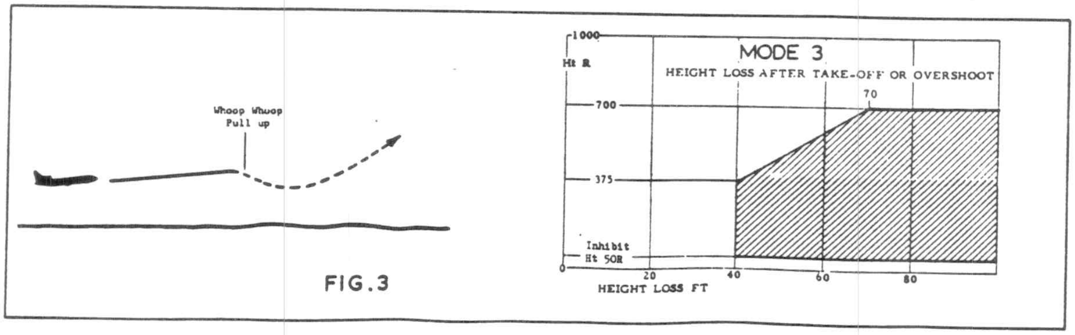


FIG. 3

GPWS WARNING ENVELOPE

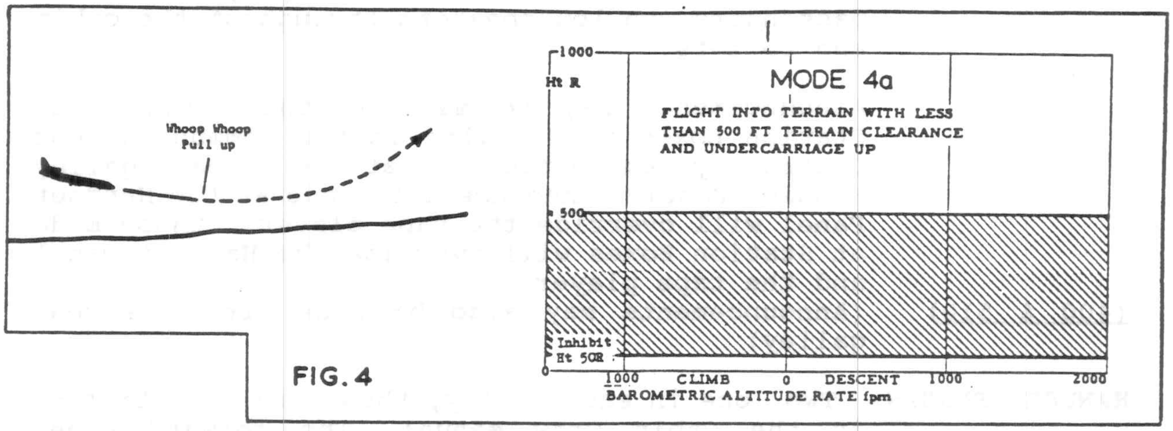


FIG. 4

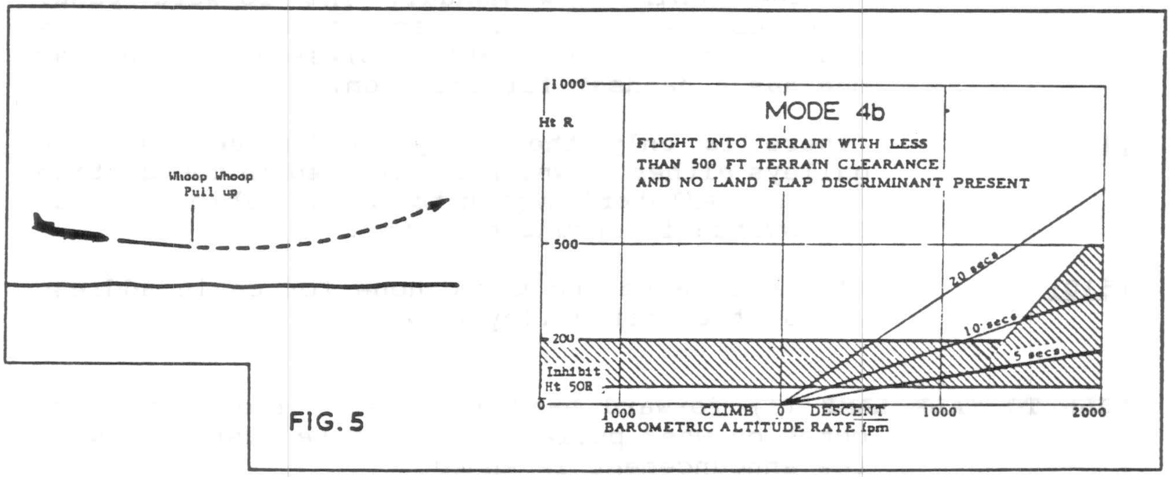


FIG. 5

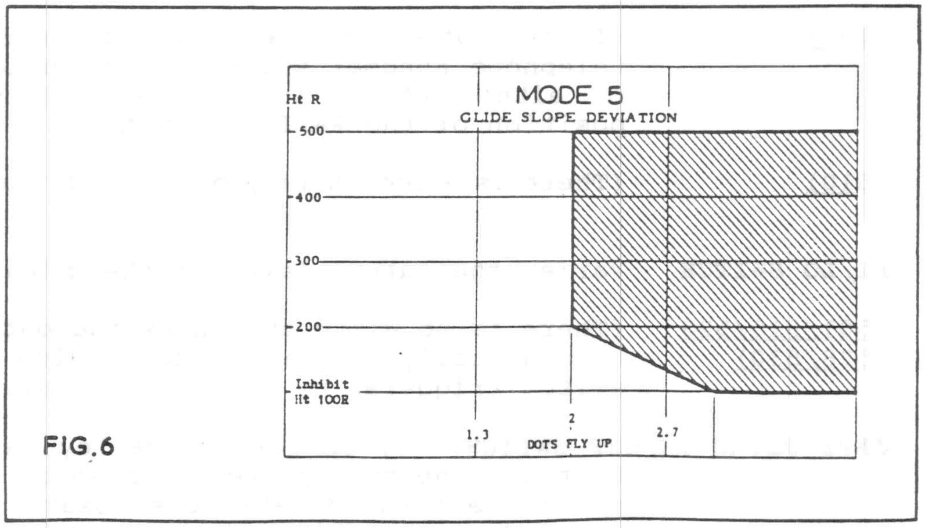


FIG. 6

CABIN ADDRESS SYSTEM

GENERAL. The Cabin Address system allows announcements to be made and taped music to be played to the passengers, on loudspeakers throughout the cabin and toilets.

Announcements may be made at the flight deck Station Boxes as detailed in the Communications Control System section, or at the forward galley Handset Panel. Announcements made at the Handset Panel will override the tape player; those made at Station Boxes will override the Handset Panel and the tape player.

(400 & 510) (Announcements may also be made from the rear galley)

HANDSET PANELS. Two, one in each galley, these are illustrated in the Cabin Crew Manual. The forward panel incorporates a telephone handset for intercom use and a microphone for cabin address use. The rear one has a handset for intercom.

(400) (There is only the telephone handset in both galleys either of which can be used in conjunction with a 'PA/Inter' switch to obtain Cabin Address. The switch is sprung to Inter.

(510) (There is a second microphone for cabin address use at the rear galley panel)

PULL TO TALK LAMP (1) forward handset panel. red lamp which comes on when pulled. It must be pushed in when the announcement is ended.

(400) (Instead of a lamp there is a sprung switch in the telephone handset which must be held in to talk on either PA or Interphone, dependant on the position of the PA/Inter switch)

(510) (There is a second lamp on the rear handset panel)

HI/LO SWITCH Varies the output level of the cabin address.

(501/515/523 528/530) (There is no Hi/Lo switch as the output level is automatically raised after engine start by a switch triggered by CSDS oil pressure)

TAPE REPRO ON/OFF SWITCH. (1) On forward galley handset panel Controls the tape player mounted on the bulkhead above the forward cabin crew seat. (400 & 539 - mounted in the flight deck hat rack)

CREW CALL LAMP AND RESET BUTTON. One of each on both galley handset panels. The lamp lights on both panels and the galley chimes sound if the flight deck steward call button on the roof panel is pressed. Pressing either reset button extinguishes both lights

If the Crew Call lamp on either panel is pressed then the chime in the flight deck port console sounds and the steward call lamp on the flight deck roof panel lights.

STEWARDS CALL LAMP AND RESET BUTTONS. One of each on both galley handset panels. Pressing the lamp on either panel brings the other on and sounds the chime. The Reset button puts the light out.

INTERCOM FLIGHT/PANTRY SWITCH. (2) one on each galley handset panel. Set to pantry to speak to the other galley, using the intercom handset, and flight to speak to the flight deck through the flight deck intercom system. Used in conjunction with the Call buttons.
(510 only)

AMPLIFIER. Mounted on the flight deck radio rack, third shelf down, this is a transistorised unit which amplifies the system inputs to the level required to drive the loudspeakers.

LOUDSPEAKERS. These are mounted in each passenger service unit beneath the hatracks, in the toilets and in the forward galley The latter is muted when the cabin address is used at the forward panel.

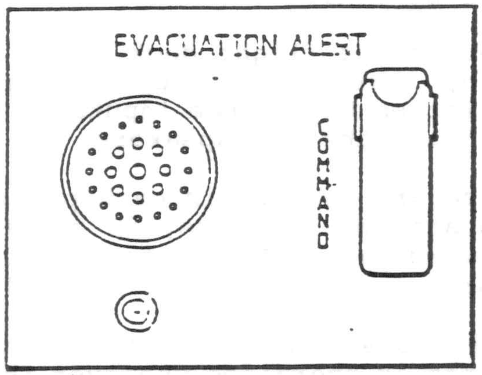
POWER SUPPLY. This is shown in Chapter 5 Power Supplies. The system is energised whenever the Essential DC Bus is live and remains available until the aircraft battery is exhausted.

EVACUATION ALARM SYSTEM

GENERAL This system is being progressively retrofitted to the 1-11 fleet. It is designed to alert the CREW to the need to evacuate the aircraft. The system consists of 3 Evacuation Alert Panels powered from the Battery Bus. The panels are located:-

1) Flight deck centre pedestal.
2) Over the forward port door, adjacent to the cabin crew seats.
3) On the port bulkhead to the rear of the last seat row, adjacent to the cabin crew seat.

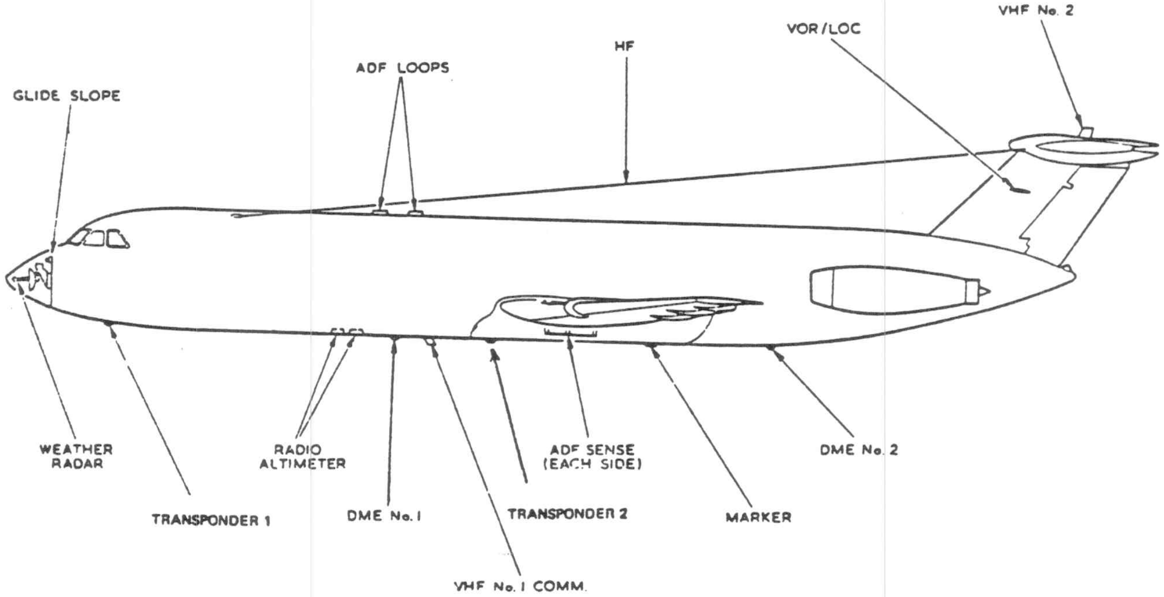
Each panel houses a warning horn, emitting a high pitched modulating tone, a guarded toggle type 'Command' switch and a red LED.



EVACUATION ALARM PANEL

The system may be activated from any panel by raising the guard and operating the command switch, when the horn will sound and the LED illuminate at all panels. The flight deck horn will self cancel after 3-5 secs, the others after 10-15 secs. The red LEDs remain illuminated until all the command switches are set to off.

AERIAL LOCATION



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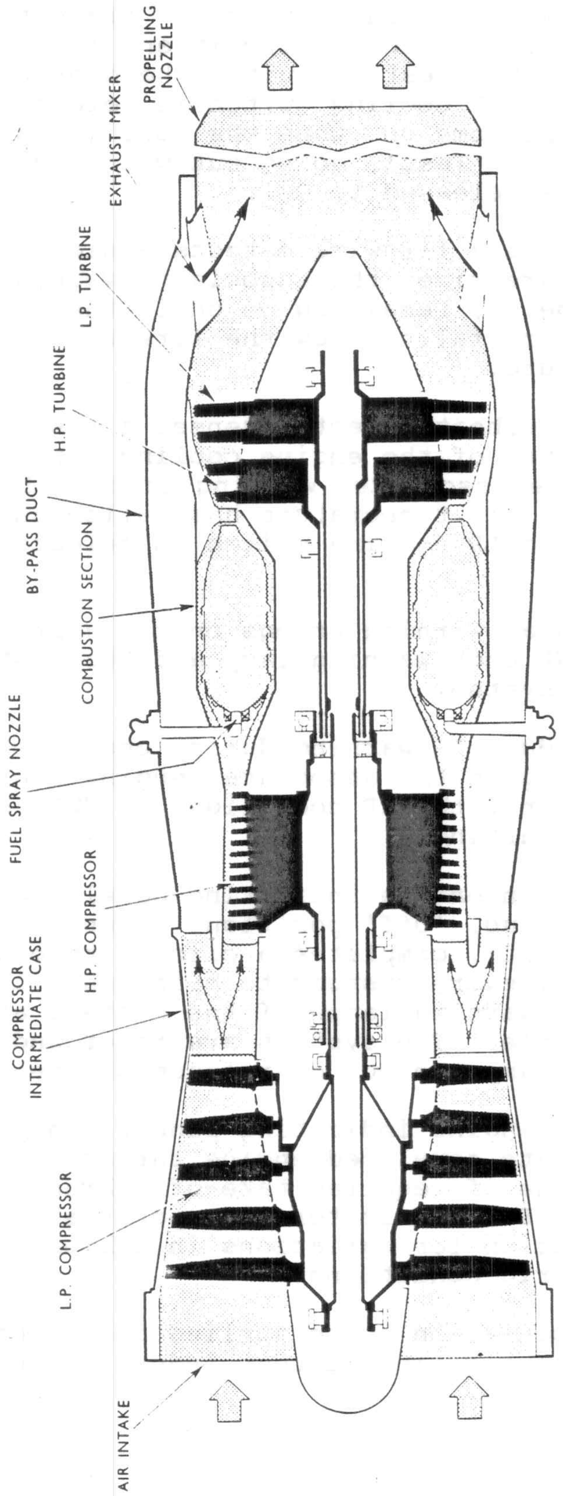

ENGINE INDICATORS AND CONTROLS

ENGINE OVERHEAT WARNING LAMPS (2), red, on engine indicator panel, centre instrument panel. One lamp for each engine firewire system (Zone 2) and cooling air overheat detector. Press to test the overheat detector circuit and lamp filament; the test circuit is held on until the associated LP Cooling switch is selected Reset. Both lamps come on when the Zone 2 test switch is selected 'Test', going out when the test switch is released to Off.

If the Zone 2 firewire detects a significant temperature rise, the associated warning lamp will come on, remaining on until the ambient temperature falls below the fire wire reset temperature.

If the overheat detector senses a rise in temperature of the engine cooling air through 460°C, the associated warning lamp is locked On until the air temperature has fallen and the associated LP Cooling switch is selected Reset.

An overheat warning brings on the appropriate engine HP Cock warning lamp and the Master Warning system.

(500 excl 510) (An air duct LP warning during engine starting will bring on the associated engine overheat lamp but not the HP cock light or MWS; see Engine Starting.)

ZONE 2 TEST SWITCH (1), on engine indicating panel. Spring-loaded to up, 'Off' position. When pressed down, 'Test', completes a circuit through both engine firewire systems to bring on both overheat warning lamps if the systems are serviceable. The systems are reset and the warning lamps go out on release of the switch.

% THRUST GAUGES (2), on engine indicating panel. Calibrated to indicate developed engine thrust as a percentage of required take-off thrust from 50 - 110%. Each indicator incorporates a manual compensation for variations in ambient atmospheric conditions.

The compensation to be applied is computed from tables as a digital thrust index, set by

cont/...

pressing and rotating the setting knob, and displayed digitally as a three-figure index (000 - 200) in a window on the instrument.

(510 only) (When rotated without pressing, the setting knob also moves a bug around the periphery of the instrument)

LP COOLING SWITCHES (2), on engine indicating panel. Spring loaded up to Off. Press and hold down to 'Reset' to cancel either engine overheat warning following test of either overheat detector circuit by pressing the warning lamp or operation of the overheat detector circuit following a rise above 460°C in the temperature of the engine cooling air.

HP RPM GAUGES (2), on engine indicator panel. Electrically operated instruments supplied from tachometer generators driven by the HP rotating assemblies of the associated engines. Main scale calibrated from 0-104% in 2% divisions; inset scale calibrated from 0-10 in 0.5% divisions.

EXHAUST GAS TEMPERATURE GAUGES (2), on engine indicator panel. Calibrated 0-700°C in 100° divisions. Gas temperature is measured by thermocouples mounted radially in each engine exhaust assembly. The thermocouples additionally supply temperature indications to the Top Temperature Control system.

LP RPM GAUGES (2), on engine starting panel, roof panel. Electrically operated instruments supplied from tachometer generators driven by the LP rotating assemblies of the associated engines. Main scale calibrated from 10-110% rpm in units of 5% inset scale calibrated 0-10% rpm, in units of 1% with subdivisions of 0.5%

FUEL FLOWMETERS (2), on engine indicating panel. Graduated 0-3,500 kg/hr, in 100 kg/hr divisions. By-pass type metering units fitted in each engine fuel line between the LP and HP pumps measure and transmit the rate of fuel flow to each engine.

OIL TEMPERATURE GAUGES (2), on engine indicating panel. Graduated from -50 to +160°C in 10° divisions. Electrically-operated instruments supplied from thermometer/transmitter units mounted at the rear of each engine oil tank.

OIL PRESSURE GAUGES (2), on engine indicating panel. Graduated 0-75 psi in 5 psi divisions, electrically connected to pressure transmitter in each engine's oil filter outlet.

FUEL TOTALISERS (2), on centre instrument panel. (Starboard console 523 aircraft) Digital indication of fuel consumed.
Not 400,515,528

OIL LP WARNING LAMPS (2), red, on centre instrument panel. On when the associated engine's oil pressure falls through 15psi. Connected to the Master Warning system. Before shutting down an engine following a low oil pressure warning, the associated oil pressure gauge indication must be checked.

ENGINE VIBRATION INDICATORS (EVIs) (2) on centre instrument panel. Calibrated 0-5 relative amplitude, in half unit divisions. Electrically driven remote indicators connected via amplifier units to vibration pick-ups mounted on each engine. Each indicator has a high frequency filter, operated by a press button on the R/H side of the instrument.
400,539 only

VIBRATION INDICATOR TEST BUTTONS (2), mounted on the EVIs, one for each engine monitoring system. Press to test system - an indication of 3.5 units should be registered on the associated indicator. (539 only the amber lamp will also light)
400,539 only

ENGINE VIBRATION WARNING LIGHTS (2), one on each EVI. The lamp will come on if a vibration exceeding 3 units is detected by the associated EVI
539 only

TURBINE VIBRATION INDICATORS (TVIs) (2), at the bottom of the centre instrument panel. Calibrated 0 to 10 units relative amplitude in single unit divisions, with an amber sector from 5 to 10 units. Electrically driven remote indicators connected via amplifiers to vibration pick-ups on each engine. The test range between 6 and 8 units is marked by a white line and should indicate when the respectve test button above each instrument is pressed.
510 only

TTC/FUEL DIP SWITCHES (2), on centre console, one for each engine. Three position switches, down 'Off', centre 'TTC Only', up 'Arm Both'. Each switch has to be pulled out to make a selection; when released, the spring-loaded lever engages a detent.

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When either switch is selected 'TTC Only', the associated engine fuel regulator unit receives TGT indications: as the TGT of that engine rises to the Type Limitation maximum, the datum setting of the governor unit is altered to progressively reduce fuel flow and stop any further rise.
When selected 'Arm Both', TTC is operative, the Auto-Ignition trigger datum is changed, and the

fuel dip system operates during the approach to a stall to prevent excessive TGTs by sharply reducing the fuel flow rate of the HP pump.

(501/510/530) (There is no fuel dip system. When 'Arm Both is selected, TTC is operative and the Auto-Ignition trigger datum is changed)

THROTTLE LEVERS (2), on centre console, moving in quadrants, connected by cables and lever systems to the engine speed governors in the fuel regulator units. The throttle levers are friction-damped to prevent creep. The reverse throttle levers are pivoted on the fwd face of the throttle levers.

Throttle lever movements adjust the datum setting of the engine speed governors, varying the HP pump output to achieve the required HP rpm. The governor unit datum is further, automatically varied to maintain the selected rpm over the aircraft altitude and speed range, and additionally limits max HP rpm, Max P3 pressure, and, when TTC or Fuel dip/datum advance is selected, EGT. The throttle levers should not normally be staggered when HP rpm are synchronised, but if LP rpm synchronisation has been used some throttle lever stagger will result and is acceptable.

The HP fuel pump delivery rate is additionally reduced to prevent an LP rotating assembly overspeed, controlled by an LP governor unit.

Microswitches in each throttle control linkage are associated with:

Take-off Configuration Warning system.
Gear Warning Horn circuit.

(500 excl 539) (Autothrottle disengage switches are fitted in the head of each throttle lever.)

REVERSE THROTTLE LEVERS (2), one mounted on each normal throttle lever, operate the selector valves for the thrust reverser systems and the reverse thrust fuel control units, and are normally locked in the fully down position by mechanical quadrant locks. The quadrant locks are released when the normal throttle levers are pulled fully rearward to Idle, and reverse thrust may then be selected. On each engine, two clamshell exhaust deflectors are operated by rams powered by P3 bleed air.

With the deflectors locked open in the forward thrust position, initial upward movement of the reverse lever locks the normal lever at Idle and moves the control valve; initially, movement of the reverse lever is baulked at the 20% position, by a cam in the actuator linkage. The mechanical lock in the system is released by the sequence valve, switching on the reverser unlocked lamp, and the deflectors are moved to the closed position, rotating the cam to release the 20% baulk as the deflectors close.

Spring-loaded rollers engage in detents to give normal reverse and reverse idle positions; the Normal Reverse position corresponds to approx 90% full reverse thrust. Full reverse thrust should only be used in emergency. For any indicated HP rpm, the thrust developed in reverse will be approximately 40% of that in forward thrust for that rpm.

Pushing the reverse throttle lever fully down and forward reduces engine power to idle rpm, and selects the clamshells open; whilst the deflectors are opening, the 20% baulk is re-imposed by camrotation. When the deflectors reach the fully open position, the sequence valve engages the mechanical lock in the actuator linkage, movement of the lock lever switching off the reverser unlocked lamp, and the normal throttle lever baulk is released.

REVERSE UNLOCKED LAMPS (2), amber, on centre instrument panel, one for each engine. On whenever the thrust reverser deflectors on the associated engines are not locked in the open (forward thrust) position.

DIFFERENCES

500 EXCL 510

START/RELIGHT SWITCHES

When the start circuit is completed on the ground, the engine generator is tripped, the hydraulic pump off-loaded, the engine antice pressure gauges show air duct pressures adjacent to the CSDS, and the engine overheat lamp is connected to the CSDS LP warning lamps circuit, by the oleo relay system in the Ground Mode. At approximately 50% HP rpm, these overrides are automatically cancelled.

If the starting air supply pressure in the CSD inlet duct falls below 14 psi, when a starting sequence has been initiated and the HP cock lever has been moved to Start or Open, a latching relay will close the CSD air shut-off valve and put on the LP warning lamp and the associated Engine Overheat lamp. The warnings can only be cancelled, and the relay reset, by selecting the Start Master switch to Off. The HP cock must be closed immediately, if an LP warning occurs.

ENGINE STARTING

ISOLATION VALVE SWITCHES (2), on air system panel, roof panel. Prime function - see 'Air Conditioning'. Prior to engine starting, the appropriate switch must be selected Open.

HP COCKS (2) on centre console - see 'Fuel'.

START MASTER SWITCH (1), on engine starting panel, roof panel.

4 position rotary switch, 'Motor', 'Off', 'Start', 'APU'. When selected 'Start', the engine starting circuit is armed; selecting 'Motor' arms the air starter valves, but isolates the igniter circuits. The 'APU' position is not connected to the main engine circuits, but completes circuits to the APU Start button.

START/RELIGHT SWITCHES (2), on engine starting panel. Spring-loaded to centre 'Off' position. With the Start Master switch selected 'Start', pressing the switch up 'Start& Motor' locks on the associated engine start relay, opens the air control valves to admit pressure air to the air motor, connects the LP Shaft Rotation lamp to the associated engine tachometer generator, and completes the engine igniter circuits.

If a pressure reducing valve or air control valve fails to operate, a manual selection can be made by a ground engineer.

The HP stage is driven to above the engine's self-sustaining speed by the CSDS air motor; on the 510 and 400 further acceleration through 5,000/40% RPM brings the generator on line, automatically releasing the engine start relay.

If an engine start sequence has to be abandoned before the start relay is automatically released, this can only be achieved by selecting the Start Master switch to 'Off'. When pressed down to the 'Relight' position, the engine igniter circuits are completed; this position functions independently with the Start Master switch in any position.

With the Start Master switch selected 'Motor', provided the associated HP Cock lever is Shut, pressing the appropriate Start/Relight switch up will complete the starting circuits, except the igniter circuits; without ignition, the

cont/...

engine cannot be accelerated beyond self-sustaining speed, and the engine start relay will therefore remain locked on until the circuit is broken by selecting the Start Master switch to 'Off'.

ENGINE AIR LP WARNING LAMPS (2), amber. Pull to isolate and test, press to arm. On panel B, port bulkhead, adjacent to fan isolate switch. Comes on when air pressure in CSDS air duct falls below 14 psi. The warning can only be cancelled by selecting the start master switch to 'Off'.
500 excl 510

IGNITER SELECTOR switch, on engine starting panel. Up 'High and Low', down 'Low'.
(400 only)

IGNITER ON INDICATOR LAMPS (4), two for each engine, amber. On engine starting panel. One pair, marked '1'and '2'(high and low on 400) for each engine's dual igniter system; come on when the igniters on the associated engine are energised by an engine start selection, relight selection, or the Auto Ignition system associated with the stall warning sensors.

LP SHAFT ROTATION INDICATOR LAMP (1), green, on engine starting panel. Connected by engine starter switch to tachometer generator driven by the LP rotating assembly of the selected engine. Flashes on/off as LP assembly rotates, at frequency directly proportional to rotation speed.

AUXILIARY POWER UNIT

APU LP COCK MAGNETIC INDICATOR (1), on engine starting panel, roof panel, marked Fuel Valve. The associated cock is opened when the APU control switch is selected 'On', shut when the switch is selected 'Off'. The MI displays cross-hatch when there is no electrical power, Open when the control switch is on and the valve open , Closed when the switch is off and the valve shut.

APU CONTROL SWITCH (1), on the engine start panel, roof panel. Marked 'Off' and 'On', the LP fuel valve is opened and the valve indicator circuit energised when 'On'is selected. With the start master switch selected to APU the starter motor circuit is armed.

With the APU running, selecting the switch to off close the LP cock and cuts off the electrical supply to the fuel booster pump and the HP cock, which is spring-biased to the shut position and therefore closes.

PUSH TO START BUTTON (1) on engine starting panel. With the circuit armed by selection of the Starter Master switch to APU and the APU Control switch to on, pressing the start button completes the circuit to the starter motor and lock-on relay; the start button can be released, the start indicator displays 'Start', and the fuel booster pump circuit is completed.

As engine rpm increases, rising oil pressure opens the HP cock (or fuel valve) and completes the ignitor circuit via closed contacts on the centrifugal speed switch. At 35% governed speed, the speed switch breaks the starter motor circuit, allowing the engine to accelerate under its own power. At 95% governed speed, the igniter circuit is broken by the centrifugal switch, and the start counter and hourmeter circuits completed, the start indicator displays 'Run', and the air delivery circuit is armed.

The APU is automatically shut down by the 110% overspeed switch operating, releasing the HP cock which then closes, and cutting off the fuel booster pump. The LP cock will, however, remain open until the APU Control switch is selected Off.

START INDICATOR. (1) Magnetic indicator, showing black when de-energised, 'Start' when the starter circuit is energised, and 'Run' when APU has reached 95% rpm. During a start, the indicator changes from black to 'Start' when the button is pressed, reverts to black as the starter circuit is released at 35% rpm. During shutdown, the indicator changes from 'Run' to black as the fuel cocks are shut.

APU OIL LP WARNING LAMP (1), amber, on engine starting panel.
(Not 400) When the APU control switch is at On, the warning lamp will be on whenever APU oil pressure is 48 psi or less.

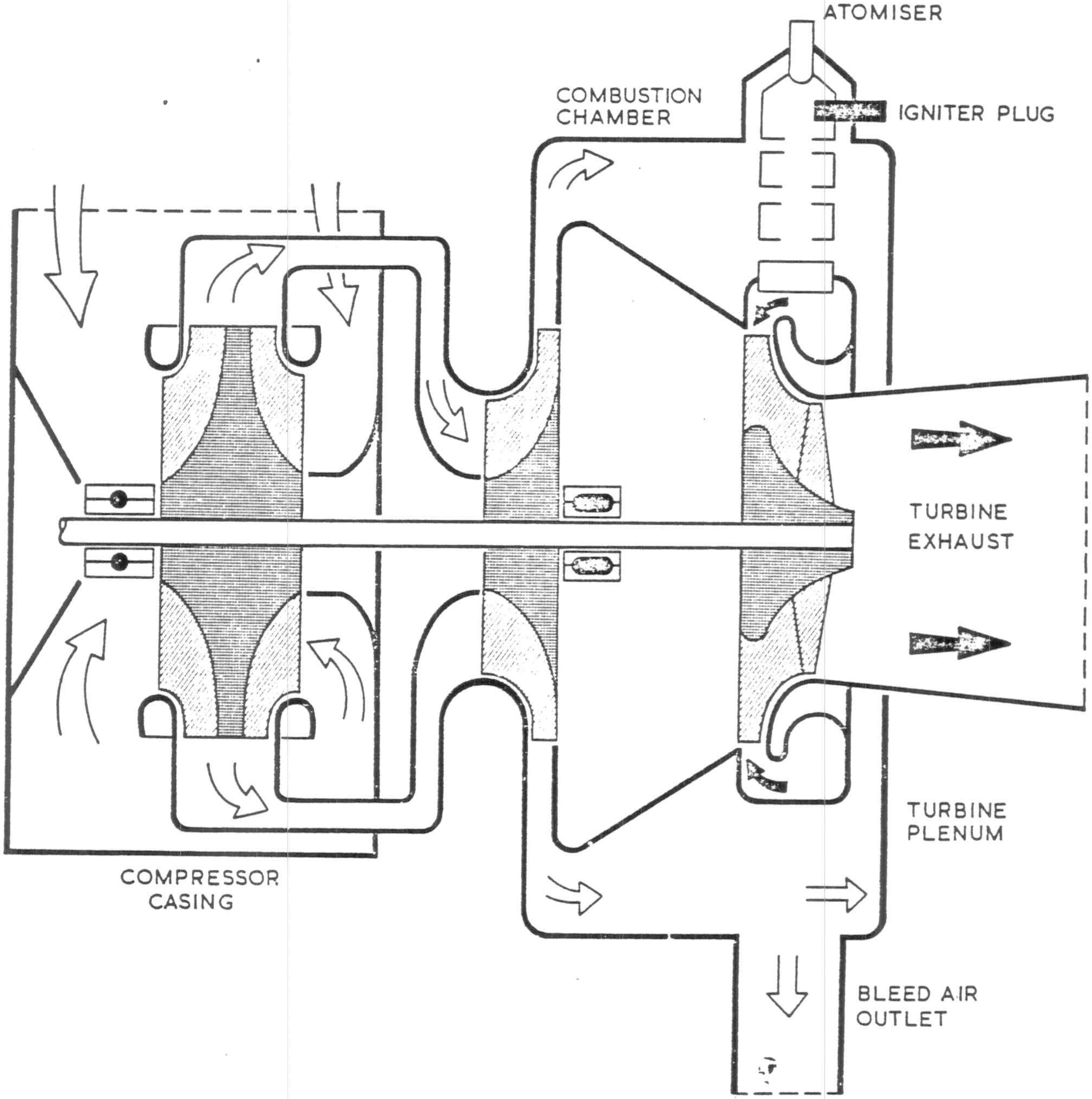
APU EXHAUST GAS TEMPERATURE GAUGE, (1) on starboard console. Graduated 0-1000oC in 100o divisions.

OVERSPEED TEST SWITCH (1) on external APU fire control panel at rear of aircraft. Spring loaded to Normal. When selected 'Test', with the APU running at its governed speed, completes a circuit to open the air test solenoid and bypass the 110% overspeed switch which should be open, thus simulating an overspeed and initiating an APU auto-shutdown; the LP cock will remain open until the APU Control switch is selected Off.

APU FIRE SHUTDOWN SWITCH.	See Fire Protection
FIRE BOTTLE SWITCH.	"
MANUAL FIRE/AUTO SWITCH.	"
FIRE CONTROL HANDLE.	"
APU FIRE WARNING LAMPS.	"
FIRE BOTTLE DISCHARGE INDICATOR.	"
FIRE ACCESS/BLOW-OUT PANELS.	"
FIRE BOTTLE PRESSURE RELEASE INDICATOR.	"

AIR DELIVERY VALVE SWITCH.	See Air Conditioning
AIR X-FEED VALVE SWITCH.	"
AIR X-FEED VALVE INDICATOR.	"

AUXILIARY POWER UNIT



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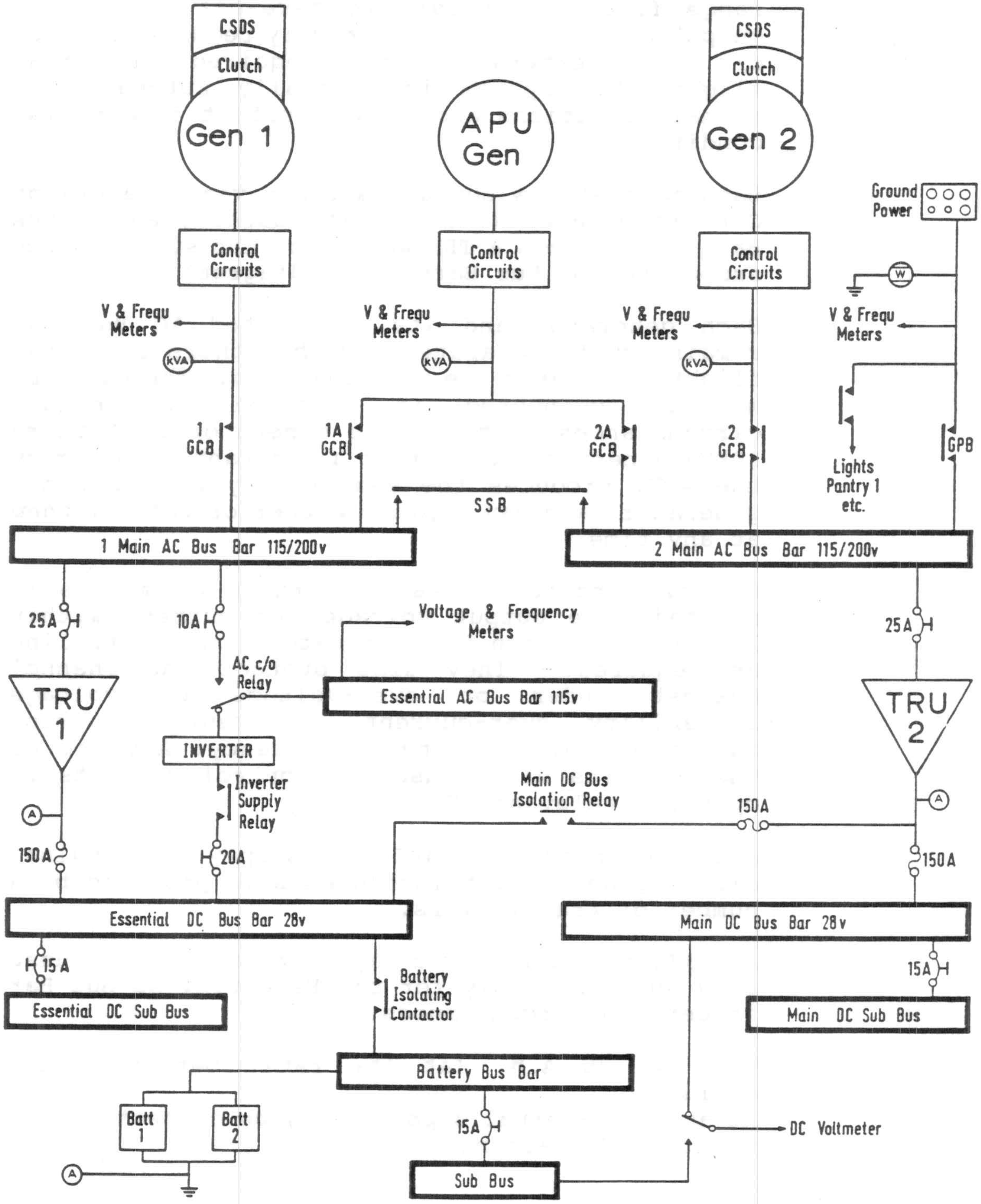
ELECTRICAL SYSTEM



GENERAL. Each engine drives a 30kVA brushless generator producing a closely regulated 400 c/s 115/200V 3 phase supply. Generator drive is taken from a Constant Speed Drive & Starter unit (CSDS) which turns the generator at 6000 rpm throughout the engine speed range from ground idle to take-off power. The output frequency is thus strictly regulated at 400 c/s so inverters are not required in normal flight. The system is virtually automatic in normal conditions and to some extent in abnormal conditions.

Each generator's output is taken via a Generator Circuit Breaker (GCB) to its associated AC Bus Bar. This feeds a TRU which in turn supplies the associated DC Bus Bars. (See diagram)

Each generator and its associated AC Bus Bar remains quite separate from the others in normal flight and shares the aircraft load. The bus bars may be connected in parallel in certain circumstances, but not the generators. A third 30kVA generator, driven at a constant 6000 rpm by the APU, produces the same supply as the other generators and may replace either or both of them at any time.

Control circuits for each generator automatically maintain the output voltage and current within limits and switch the generators on or off line as required. They also protect the channel against under or over-voltage or voltage instability, over-current, differential current faults and over or under frequency. Any one of these faults will cause the control circuits to open the relevant GCB.

A single phase 26V 400 c/s supply for engine, airframe and flight instruments is provided by a number of transformers.

A 300VA static inverter may provide a single phase 115V 400 c/s supply for the Essential AC Bus Bar in certain circumstances.

Two 24V 25 A.h. (at 1hr rate) batteries are carried.
AC and DC external supplies may be connected; the DC for APU starting only.

GENERATION

The system controls and indicators are mounted in the roof panel.

GENERATOR CONTROL SWITCHES (3). Marked 'Trip' 'Norm' 'Reset', the switches are sprung to 'Norm' and control the generators as follows:-

'Norm'. In this position the system is allowed to function automatically so that when a generator is rotated, the self-exciting field current it produces is passed to the field windings. An output is thus produced ready for connection to the AC Bus Bar. If at any time voltage and current requirements are not met the field circuit is opened thus collapsing the generator output.

When the generator output reaches acceptable limits, in the case of the APU the GPB (if closed) and SSB are opened and 1A & 2A GCB's are closed thus energising both 1 & 2 Main AC Bus Bars. (See diagram.) If Generator 1 now comes within limits, 1A GCB is opened and 1 GCB closed so that 1 Main AC Bus is fed from Generator 1 in place of the APU generator which continues to feed 2 Main AC Bus. Generator 2 reaching limits now causes 2A GCB to open and 2 GCB to close thus supplying 2 Main AC Bus in place of the APU which remains available if needed.

In flight, with the APU closed, down, failure of Generator 1 or 2 will cause the associated GCB to open and the SSB to close, leaving the remaining generator supplying 1 & 2 Main AC Bus Bars. Most galley supplies, the Air Conditioning Fan flight control supply and (except on 400 series a/c) 1 (AUX) Hydraulic Pump if 2 (AUX) Hydraulic Pump is selected are then automatically shed. If the APU is now started, its generator output, on coming within limits, will open the SSB and close the relevant 1A or 2A GCB so that the failed generator is replaced by the APU. The shed loads are then automatically re-connected.

If necessary, the automatic closure of the SSB may be prevented by tripping the 'AC Split' circuit breaker on the aft end of Panel P.

If a second generator, APU or main, were to fail, the above loads would again be shed, the SSB close and the remaining generator would continue to supply both Main AC Bus Bars.

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Failure of this last remaining generator would allow the AC Changeover Relay to relax. This would switch the Essential AC Bus Bar from 1 Main AC Bus to the Inverter and, provided the Battery switch was on, close the Inverter Supply Relay to energise the Inverter from the Essential DC Bus. (See diagram) The DC Main Bus Isolation Relay would open and the aircraft could then continue for a further 45 minutes with the Essential AC Bus, the Essential DC and DC Sub Bus Bars, the Battery and Battery Sub Bus Bars all energised from Batteries 1 & 2.

'Trip'. The generator field circuit is tripped open to prevent or collapse any output.

'Reset'. This resets the relay that opened the field circuit at 'Trip' and must be selected momentarily before any generator output is possible if 'Trip' has been selected.

KVA METERS (3). One for each generator, calibrated 0 to 40. These show the load, in Kilovolt-Amps (KVA), when the generator is on line.

FREQUENCY METER (1) The frequency meter is calibrated from 300 to 500 cps.(350 to 450 on 400 series aircraft) The sector 380 to 420 cps is coloured green and indicates the frequency range over which the control circuits operate normally. The amber sectors either side have no significance.

AC VOLTMETER, (1) The voltmeter is calibrated from 70 to 130 V.

SELECTOR SWITCH. The switch connects the frequency and voltmeters to the External supply (Ext), Gen 1 or 2, the APU Gen or the Essential AC Bus (Ess).

GEN FAIL WARNING LAMPS (3), Amber, one for each generator. Generator 1 and 2 lamps come on when their GCB's are open. The APU generator lamp comes on when 1A and 2A GCB's (see diagram) are open and either or both 1 and/or 2 GCBs are open, all provided that the Essential DC Bus is energised. (ie the APU lamp will not come on while both the engine generators are on line)

(510 only) (All three lights are connected to the amber MWS.)

CSD DISCONNECT/NORMAL SWITCHES (2) Guarded. When selected to Disconnect, (marked 'Discon'), the coupling between the engine and CSD is disengaged and locked. There can be no re-connection in flight.

CSD FAIL LIGHTS (2), amber, one for each CSDS. Come on if the oil pressure within the associated CSDS falls below 11psi.

BUS FAIL WARNING LAMPS (2), Red. For AC Main Bus Bars 1 & 2. These go out when the bus bar voltage reaches 175 and come on when it falls to 170. The lamps are connected to the MWS.

GROUND POWER LAMP & SWITCH. The white lamp comes on, when a live AC ground supply is plugged in, to show that power is available. The switch is marked 'On' & 'Trip', spring loaded to the centre, Off, position and controls the Ground Power Breaker (GPB) as follows:-

'On' this closes the GPB thus connecting the ground supply to 2 Main AC Bus provided all three aircraft generators are off line and the voltage and phase sequence of the ground supply is correct.

'Trip' This trips open the GPB and energises two relays which supply the toilet and cabin fluorescent lights direct from the ground supply regardless of the lights' switch positions. Galley 1, freight bay lights and cleaner sockets are also supplied direct from the ground supply.

STATIC INVERTER TEST SWITCH & MI. (500 excl 510) Provided that the Battery switch is On, selecting 'Test' energises the Inverter and connects its output to the Essential AC Bus as can be seen on the Frequency and AC Volts meters. The MI, which shows the Essential AC Bus supply source, changes from 'Main' to 'Invert'.

AC GROUND SUPPLY POINT. This is a six pin plug mounted on the lower fuselage, port side, forward.

DC GROUND SUPPLY POINT. In the electrical bay. This is a three pin plug connected to the APU starting circuit only. It allows an external 28V DC supply to replace the aircraft battery.

DC SUPPLIES

TRU. There is no control switching for the TRU'S which are energised, 1 and 2 respectively from 1 & 2 Main AC Bus Bars. TRU 1 feeds the Essential DC Bus and TRU 2 the Main DC Bus with 28V DC, via a 150A fuse in each case, supplies being automatically available whenever the Main AC Bus Bars are energised.

TRU AMMETERS (2). Calibrated to 200 Amps, these show the load on each TRU. Limitations are given in the Flying Manual.

DC FAIL WARNING LAMP. Red. This comes on to show that there is no output from either TRU, or that their output voltages have fallen below 24.5V and that the Main DC Bus and Main DC Sub Bus Bars are isolated from the other DC bus bars. (See diagram.)

The Main and Essential DC Bus Bars are normally connected together so that failure of either TRU will not leave the associated DC bus bars unenergised. Connection is via the Main DC Bus Isolation Relay which closes, provided the Essential DC Bus is live, when the Main DC Sub Bus Bar voltage rises above about 26V. The Battery Bus is also normally connected to the Essential DC Bus so as to keep the batteries fully charged. To prevent the load on all six DC bus bars falling on the batteries in the event of failure of both TRU's, the Main DC Bus Isolation Relay opens when the Main DC Sub Bus Bar voltage falls to 24.5V thus shedding the Main DC Bus and Sub Bus Bar loads.

The DC Fail warning lamp is energised, via relaxed contacts on the relay, from the Main or Essential DC Bus and is connected to the MWS.

BATTERIES. (2) 24V 25Amp.hr. (at 1 hr rate) batteries are carried in the electrical bay. They are permanently connected to the Battery Bus to which is connected, via a 15A cb, the Battery Sub Bus Bar. The Battery Bus Bar may also be connected to the Essential DC Bus Bar via the Battery Isolating Contactor (See diagram) which is closed when the Refuel Master switch is On, the hydraulic DC Pump switch is at 'Brake Acc' or the Battery switch is on.

BATTERY SWITCH. (1) This is simply an on-off switch in the Battery Isolating Contactor coil circuit.

BATTERY MAGNETIC INDICATOR. (1) Adjacent to the Battery switch, shows 'ON' when the 'Battery' switch is On, the Battery Isolating Contactor is closed and the Battery & Inverter Indication cb287 is set. It shows 'OFF' otherwise.
(Not 510)

BATTERY AMMETER. (1) Calibrated -100 to +100 Amps. This shows the rate of battery charge or discharge.

DC VOLTMETER. (1) The DC voltmeter, calibrated from 18 to 30V, is normally connected to the Main DC Bus Bar and therefore shows the voltage on this and the Main DC Sub Bus Bar, the Essential DC Bus Bar and Essential DC Sub Bus Bar all of which are normally connected together.

PUSH FOR BATTERY VOLTS BUTTON. (1) The 'Push For Battery Volts' button transfers the voltmeter to the Battery Sub Bus Bar thus showing the voltage on this and the Battery Bus Bar provided also that the Battery switch is off. Otherwise, the voltage will be the same as if the button were not pressed.

DISTRIBUTION PANELS

GENERAL. Circuit breakers and four fuses are carried on panel B, circuit breakers only on panel P on the flight deck and on the galley panels. They are all titled with the circuit they protect. A red lamp inside panel B comes on when the Main AC Bus Bars are live and would be seen if the panels were opened. Another red 'power on' warning lamp is fitted in panel J in the electrical bay.

OLEO CONTROLLED SYSTEMS

GENERAL. Operation of the systems listed overleaf is automatically modified, according to whether the aircraft is in flight or on the ground, by a number of relays. These are arranged in two groups and energised, when weight is on, via micro-switches on the main oleos, one group through the port switch and the other through the starboard. The port and starboard groups of relays are each again divided into two sub-groups and all four sub-groups have separate power supplies, through the 'Landing Gear Relays (Left & Right)' circuit breakers on panel 'B', from the Essential DC Bus Bar.

System	Ground State	Flight State
Cooling fan flap	'Auto' flap open 'Shut' flap shut	Flap shut
Gen cooling c/o	Induced air	Ram air
Port turn and slip and stanby horizon (510 only)	Inop with HP cock closed	Operative
Standby steering	Operative	Inop
Ice detector	Inop except test	Operative
Landing Gear up selection	Inop without excessive force	Operative
Main braking (Anti-Skid on)	Operative	Inop
Stick shake	Inop except test	operative
Auto Ignition	Inop except test	Operative
Stick push	Inop except test	Operative (No test)
Airframe Antice	Inop except test	Operative
CVR erase	Operative	Inop
Gust damping	Available	Inop
Lift dump	Operative	Inop
Aux pump 1 (Not 400)	Operative when load shed relay at shed and aux pump 2 on	Inop with load shed relay at shed and aux pump 2 on
Drain mast heater	Low (DC) heat	High (AC) heat
T/O config warning	Operative	Inop
Conditioning fan motor	Operative at normal	Operative only with gear down, speed below 165 kts load shed relay open and Aux pump 2 off
Flight recorder	Stops 30secs after landing	Starts if start switch not used

MASTER WARNING SYSTEM (MWS)

MASTER WARNING LAMPS. (2). These red lamps are mounted one on each main instrument panel and draw attention to the warning lamps listed below. A 5 seconds delay on the booster pump and bus fail warnings prevents transient conditions from operating the flashers.

Eng Overheat
Oil LP
Ice Warn
Cabin Altitude
Servo Fail
Elev Emerg Fail
Booster Pump LP
DC Fail
Bus Fail

In the air, flashing of the Master Warning lamps would normally be cancelled by pulling out the head of the system warning lamp which caused the flashing. The system warning lamp then remains on as a reminder that attention is required and the MWS is then ready for further warnings. The flashing would also be cancelled by the disappearance of the reason for the system warning light.

Alternatively, the flashes may be totally inhibited by pulling out the heads of the Master Warning lamps. This would usually be done on the ground to prevent continuous flashing when aircraft systems are not operating normally, and to avoid the necessity of pulling out the heads of a large number of system warning lamps. With their heads pulled out, the Master Warning lamps show a steady light, provided that the Essential DC Bus is energised.

The MWS may be tested by pressing any of the system warning lamps shown above. The Master Warning lamp heads must be in their normal operating position and the 5 second delay will still obtain, where relevant.

LIGHTING EXTERNAL

NAV LIGHTS ON/OFF SWITCH. (1) Roof panel. This controls conventional wing tip and dual white tail navigation lights. The tail lamps, mounted on the aft end of the bullet, have only one filament on at any time as determined by the dual tail switch.

DUAL TAIL SWITCH. Marked Upper-Lower. Aft steward's panel. This is a changeover switch for the white, tail navigation lights.

BEACON ON/OFF SWITCH. Roof panel. This is a single pole switch controlling supply relays for the upper and lower fuselage mounted rotating anti-collision beacons. Each beacon has two filaments both of which are lit when the switch is On. The filaments are DC fed, the motors AC.

RUNWAY TURN OFF LIGHTS SWITCHES. Roof panel. These are double pole on/off switches, marked LEFT and RIGHT, each of which controls via a relay, the 28V DC to the appropriate turn-off lamp. The lamps are 250W each and are mounted, with a 45 degree outward squint, in the wing root fairing.

(510 only) (There is only one double pole switch which controls both left and right turn-off lights)

FIN SWITCH. (1) (Not 400/510) Roof panel. On - Off, controlling a lamp on each wing tip trailing edge illuminating the fin.

LANDING LAMPS SWITCHES. (6). Roof panel. Landing/Taxi lamps, one in each wing and beneath the nose, are controlled by these switches as follows:-

Main lights;

'Retract' - 'Off' - 'Extend' switches (2). Each of the left hand two switches, in the upper row of four, controls the extension of a wing lamp, as marked. The 115V AC 'extend' or 'retract' actuator supply is automatically cut off with full extension or retraction of the wing lamps,

'Taxi' - 'off' - 'Land' switches (2). The port and starboard 'Main' switches control relays which bring 115V AC supplies to the corresponding wing lamp units, provided that the lamps are extended beyond a certain angle. The 115V is then transformed down to 26V and fed to either the land or taxi filament as selected. (400 & 539 there is only a single 1000W quartz filament which is illuminated if either 'taxi' or 'land' is selected.)

Nose light;

'Retract' - 'Extend' switch (1). The left hand switch of the lower two controls the nose lamp position and similar control is exercised over the 28V DC supply to the nose lamp actuator as in the main lamps.

'Off' - 'Land' switch (1). The lower right switch on the panel controls the filament supply to the 250W filament in the nose lamp. This filament may be lit with the lamp retracted or extended.

Ice Inspection Lights. See Ice and Rain Protection

LIGHTING INTERNAL

EMERGENCY LIGHTS

GENERAL. Two emergency lighting systems are provided. System 1 incorporates 15 lamps, energised from the Essential DC Bus, mounted in the normal lighting fittings and located;

Both forward doors 1 each
Cabin roof 10
Aft vestibule 1
Toilets 2

These lights come on, regardless of any other switch position, when the 'Fasten Seat Belts' switch is 'On', provided the Essential DC Bus is live. They are also partly controlled by the 'Emerg Lts' switches as shown below.

System 2 has interior and Exterior self-contained, nickel-cadmium battery driven, twin filament, solid-state electronically switched units located-

Interior	Exterior
* Flight deck 1	Rear u/wing fairing p & s
* Both forward doors 1 each	
* O'wing emerg exits 1 each	
* Aft vestible 1	
* Top of ventral steps 1	
Bottom of ventral steps 1 (Not 400)	
Cabin roof 6 (400 - 5)	

The following additional exterior lights are fitted to all aircraft except 400 & 510

Both forward doors 1 each
Near wing l/edge p & s
Near wing t/edge p & s
O'wing emerg exit 1 each

(539 only) (There is an additional interior fixed system 2 light at the roof sign near the galleys)

(400 only) (On aircraft BBME and BBMF system 2 external lights are fitted in the forward passenger and service doors)

cont/...

The lamps in the Interior list marked * incorporate their own 'On' - 'Arm' switch and may be unshipped and used as hand lamps. Their switches would normally be at 'Arm' when fitted to the aircraft but may be put 'On' if other switching has failed.

To check if the external overwing lights (where fitted) are serviceable look through the clear plastic button fitted to the top of each exit.

EMERG LTS SWITCH, marked 'On' - 'Arm' - 'Off'. Roof panel.

'On'. System 1 and 2 lights come on, provided the Essential DC Bus is energised. This is required only initially for System 2 unit switching. System 2 batteries charging from the Essential DC Bus.

'Arm.' Normally in this position in flight, it allows System 1 lights to come on automatically if the Main DC Bus Bar is de-energised, and System 2 lights to come on if 1 & 2 Main AC Bus Bar voltage falls to 170, provided the Essential DC Bus is energised to provide the initial switch-on supply for System 2 and permanently for System 1. System 2 batteries being charged from the Essential DC Bus.

(400 only) (Both systems are triggered when the Main DC Isolation relay is de-energised)

'Off'. This must be selected to put System 2 lights out, however they were switched on, before returning the switch to 'Arm'. The automatic function of both systems is inhibited but System 1 lights will come on if 'Fasten Seat Belts' is put 'On'.

EMERGENCY LIGHTS SWITCH, marked 'On' - 'Normal', forward galley panel. When selected On this switch overrides the Emergency Lights switch in the flightdeck.

(Not 400/510)

'On'. Function as On at the flight deck switch.

'Normal'. Leaves control of the emergency lights with the flight deck switch.

ESCAPE PATH LIGHTING SYSTEM. This consists of a number of high intensity white lights fitted to the legs of aisle seats on the starboard side of the cabin,

cont/...

together with strobe lights fitted at each normal and emergency exit. The lights are powered by dry cell non-rechargeable batteries which have a minimum life of 15 minutes. The lights are triggered by two radio transmitters mounted in the hat racks at the front and rear of the cabin and are intended to assist the evacuation of a smoke-filled cabin by giving a floor level indication of the escape path to the exits.

Control of the radio transmitters and thereby the lights is through the emergency lights switch and they operate in the same circumstances as the system 2 lights.

CHART LT SWITCH. P3 panel. A dimmer switch controlling a single white lamp in the flight deck roof fitting to light P3 position.

PANEL LTS SWITCH. P3 panel. A dimmer switch controlling P3 panel Plastek type lighting.

WHITE FLOOD/STORM LIGHTS SWITCH. Port roof panel. A Bright-Off-Dim switch controlling the port and stbd. fluorescent lamps beneath the glareshield.

(510 only) (An on/off switch marked 'Storm')

ROOF PANEL SWITCH. Port roof panel. A dimmer switch controlling Plastek type lighting of the port, centre and stbd roof panels.

CHART SWITCHES (2). Port & stbd roof panels. Dimmer switches controlling adjustable lamps mounted above P1 and P2.

LEFT FLOOD/PORT PANEL RED WHITE SWITCH. Port roof panel. A double dimmer switch controlling the port instrument panel red and white floodlighting.

INSTRUMENTS LEFT/PORT PANEL PILLAR SWITCH. Port roof panel. A dimmer switch controlling the port instrument panel integral or pillar white lighting.

CENTRE FLOOD RED WHITE SWITCH. Port roof panel. A double dimmer switch controlling the centre instrument panel red and white floodlighting.

INSTRUMENTS CENTRE/CENTRE PANEL PILLAR SWITCH. Port roof panel. A dimmer switch controlling the centre instrument panel integral or pillar white lighting.

ESCAPE PATH LIGHTING On the above aircraft this system comprises a strip of lights set into the cabin floor on the starboard side of the aisle. The escape path lights are white, becoming red by the emergency exits. There are identifier lights on the cabin wall by each emergency exits.

The system is powered from the DC essential bus and is triggered and operates in the same way as the system 2 emergency lights, though it has no independant batteries and relies on supplies from the DC essential bus.

RIGHT FLOOD/STBD PANEL RED WHITE SWITCH. Starboard roof panel. A double dimmer switch controlling the stbd instrument panel red and white floodlighting.

INSTRUMENTS RIGHT/STBD PANEL PILLAR SWITCH. Starboard roof panel. A dimmer switch controlling the stbd instrument panel integral or pillar white lighting.

DME IND. DIM SWITCH (1) port inst. panel. Controls DME (510 only)indicator lighting.

ROOF LIGHTS SWITCH. Port roof panel. An On/Off switch controlling a single white lamp in the flight deck roof fitting. This light takes its supply directly from the battery and is available even with the battery switch off.

FLIGHT DECK RED FLOOD SWITCH. Port roof panel. A dimmer switch controlling a single red lamp in the flight deck roof fitting.

PEDESTAL FLOOD RED - WHITE SWITCHES (2). Stbd roof panel. Dimmer switches controlling red and white lamps in the flight deck roof fittings.

COMPASS LIGHT SWITCH. Port roof panel (510 - stbd roof). An on/off E 2B Compass light switch.

RADIO CONSOLE PANELS DIALS SWITCHES. Starboard roof panel. These are double dimmers controlling radio and panel lighting on the pedestal and the oxygen regulator panel, Weather Radar controllers, brake temperature gauges, stick push indicators APU TGT gauges and the Flight Recorder on the side consoles.

BRIGHT-OFF-DIM SWITCH. Panel P. A changeover switch controlling the red, Plastek type, cb panel lighting.

MAP TABLE SWITCHES (2). Port & stbd, above nose steering wheel. Dimmers controlling adjacent white lights.

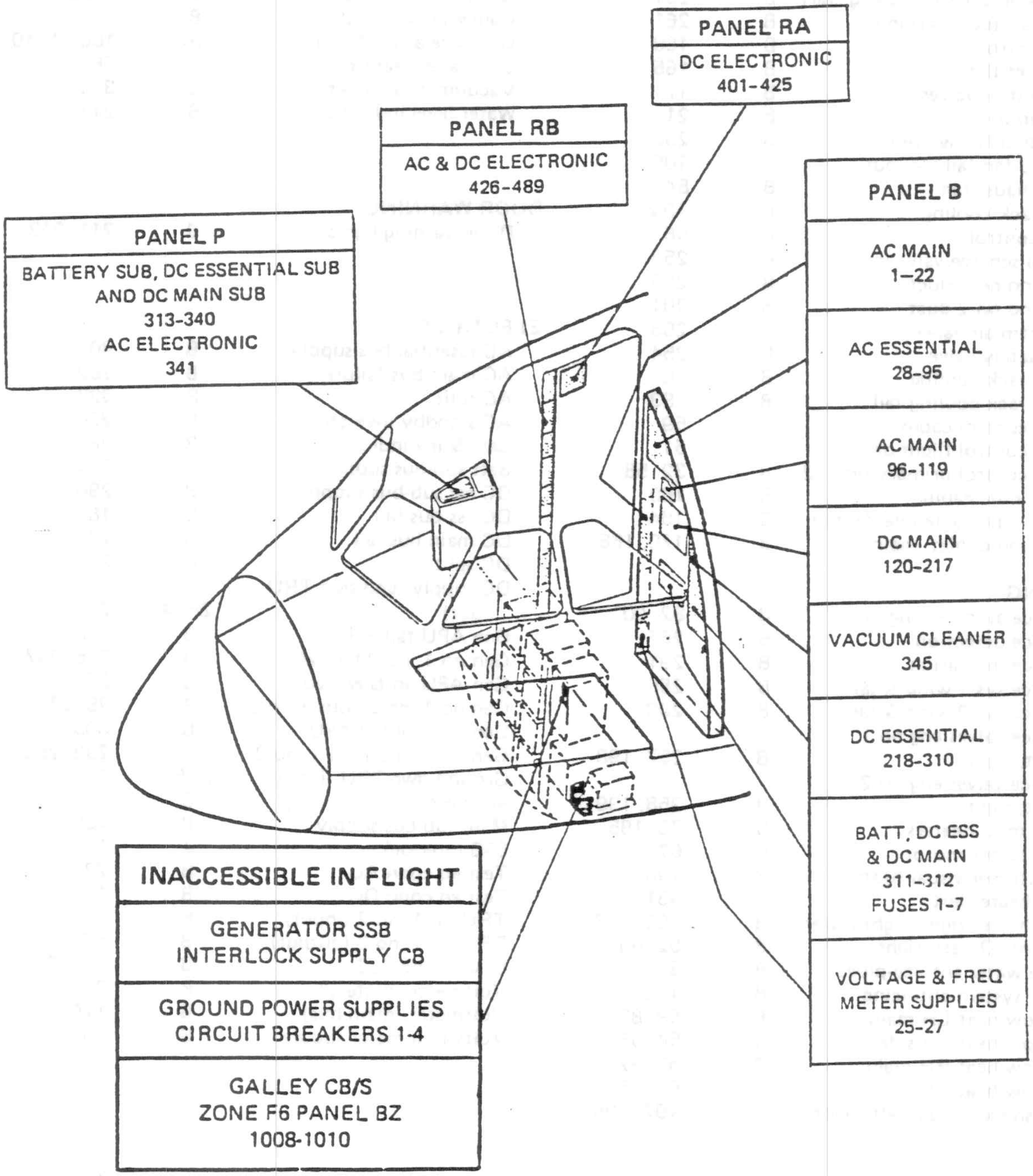
WHEEL WELL SWITCH. Roof panel. On/off switch controlling white lights in each wheel well and master-controlling the electrical bay lights.

ELECTRICAL BAY LIGHTS SWITCH. On/off switch on the battery structure. Controls two electrical bay lights under master control of 'Wheel Well' switch.

CARGO HOLD LIGHT SWITCHES (2). At hold doors, controlling ten lights in forward hold and six in the aft. Supply for these lamps is taken from the ground supply direct when one is plugged in but the GPB is open; from the Main DC Bus otherwise.

SPARE BULBS. These are carried in stowages in the inboard edge of panel B or in the flight deck hatrack

ELECTRICAL DISTRIBUTION 539
FUSE AND CIRCUIT BREAKER LIST



FUSE & CIRCUIT BREAKER LOCATION CHART

AIR CONDITIONING

	PANEL	CB-FUSE
Air sys no 1 - air cond	B	163
Air sys no 1 TCV pos & MV duct & CAU o/h	B	260
Air sys no 2 TCV pos & MV duct & CAU o/h	B	173
Air sys no 1 isol valve & sys fail	B	259
Air sys no 2 isol valve & sys fail	B	172
Air sys no 2 IV fail & eng start	B	251
Cabin altitude warning	B	261
Fan control	B	168
Fan inlet flap	B	165
Fan shutter valves	B	171
Fan supply	B	21
Fuse duct fail warning	B	252
Ground fan fail lockout	B	105
Lav exhaust fan	B	84
Main rack cooling	B	108
Press control	B	56
Press discharge valve ind	B	253
Press ind no 1 duct	B	266
Press ind no 2 duct	B	201
Press ram air valve	B	255
Press safely valve	B	254
Radio rack cooling	B	104
Radio rack cooling fail	B	183
Temp control cabin	B	59
Temp control flight deck	B	51
Temp control primary no 1, 2	B	32, 58
Temp indic cabin	B	169
Temp indic cycle inlet/outlet	B	164
Temp indic inlet, main	B	170, 166

ANTICING

	PANEL	CB-FUSE
Anti-ice air press eng no 1, 2	B	82, 90
Anti-ice detection	B	267
Anti-ice indication	B	291
Anti-ice sys 1 wing & tail	B	256
Anti-ice sys 2 wing & tail	B	200
Anti-ice valves eng no 1 left, right	B	257, 198
Anti-ice valves eng no 2 left, right	B	258, 199
Drain mast heaters	B	73, 195
Ice detector motor	B	67
Ice detector visual heater	B	190
Pitot heater left	P	331
Pitot heater right, right lower	B	192, 193
Pitot htr Q, left, right	B	52, 60
Waste water anti-ice-pipes	B	55
Water system anti-icing	B	113
Window heat LH main	B	69, 85
Window heat LH side	B	54, 68
Window heat RH main	B	62, 92
Window heat RH side	B	61, 75
Windshield u/heat left, right	B	197, 196

CENTRAL WARNING SYSTEM

	PANEL	CB-FUSE
Warning light test	B	242

DOMESTIC SERVICES

	PANEL	CB-FUSE
Galley load shed	B	91
Galley power no 1	B	19
Galley power no 2	B	8, 20
Galley power no 3	B	7
Galley relays (ZNF6)	BZ	1008-1010
Lav water heaters	B	76
Vacuum cleaner skt	B	345
Water level indication	B	217

DOOR WARNING

	PANEL	CB-FUSE
Door warning lights	B	211, 212

ELECTRICS

	PANEL	CB-FUSE
AC essential bus supply	B	80
AC main bus failure	B	289
AC split	P	323
AC standby inverter	B	294
Batt & inv indic.	B	287
Batt sub-bus supply	B	311
DC ess sub-bus supply	B	290
DC ess bus fail	B	189
DC main bus fail	B	288
DC split	P	315
DC supply (gnd pwr TRU out)	ZnF4	2
Gen APU fail w/l	B	305
Gen no 1, no 2 fail w/l	B	296, 297
Gen APU volts & freq	B	26
Gen no 1, no 2 volts & freq	B	25, 27
Gen control pnl APU	B	303
Gen control pnl no 1, no 2	B	292, 293
Ground pwr TRU (input)	ZnF4	1
Main ess bus link	B	F4
Main sub bus supply	B	188
SSB interlock	J	1
Test eq conn AC	B	22
Test eq conn DC	B	191
TRU no 1, no 2 (input)	B	17, 18
TRU no 1, no 2 (output)	B	F3, F5
U/V det no 1, 2	B	11, 12
Voltmeter (battery)	P	320
Voltmeter (main bus)	B	176
Volts freq meter supply	B	46

	PANEL	CB-FUSE
ENGINES (NOS. 1 & 2)		
Air sys crossfeed valve	B	167
Eng start & CSD dis no 1, 2	B	300, 301
Firebell	P	333
Firebottle ind	B	274
Fire det zn 1 eng no 1, 2	B	39, 41
Fire det zn 2 eng no 1, 2	B	40, 42
Fire ext no 1, 2 shot	P	316, 317
Fire & o/h bypass eng no 1, 2	B	277, 280
Fire & o/h zn 1 eng no 1, 2	B	275, 278
Fire & o/h zn 2 eng no 1, 2	B	276, 279
Generator cooling no 1, 2	B	298, 299
Igniter no 1, eng no 1, 2	P	326, 327
Igniter no 2, eng no 1, 2	B	177, 178
Oil press inds no 1, 2	B	47, 48
Oil press l/p no 1, 2	B	262, 263
Oil temp ind no 1, 2	B	264, 265
Thrust reversers unlock no 1, 2	B	228, 229
Vibration inds no 1, 2	B	37, 38
ENGINES (APU)		
Eng control c/feed valve ind	B	304
Fire detector	P	338
Fire detector	B	43
Fire extinguisher	P	318
Fuel pump	B	306
Fuel valve	P	337
Ground control	ZnF4	4
Start & control	B	F1
FLIGHT CONTROL SYSTEM		
Air data sensor	RB	455
Auto-pilot AC, DC	RB	485, 435
Auto-pilot C/O	RA	405
Buffer amp no 1	RB	434
Buffer amp no 2	RA	424
Compass dir ind left, right	RB	453, 465
Compass left, right	RB	445, 464
HDI attitude no 1, 2	RB	447, 468
HDI mode no 1, 2	RA	407, 423
HDI selector RL1	RA	422
HDI selector RL2	RB	433
High speed warning no 1, 2	B	204, 205
Horizon monitor	RA	406
IFS attitude no 1	RB	458
IFS command no 1, 2	RB	454, 467
Mach trim AC, DC	B	100, 182
V/Gyro no 1, 2	RB	446, 466

	PANEL	CB-FUSE
FLYING CONTROLS		
Elev trim tab indic	B	28
Rudder feel fail	B	225
S/b elevator control	B	227
FUEL		
Booster pump left, fwd, aft	B	5, 6
Booster pump right, fwd, aft	B	10, 9
Contents left, centre, right	B	34, 35, 36
De-fuel valve, ind	B	247, 248
Flowmeter no 1, 2	B	120, 121
Low pressure left, right	B	122, 123
Low pressure no 1, 2 sys	B	245, 246
Refuel control	B	244
Temp indicator	B	128
Top temp & dip control no 1	B	66, 126
Top temp & dip control no 2	B	74, 127
Valve crossfeed	P	329
Valve l/p left, right	P	328, 330
HYDRAULICS		
Acc. brake press brakes	B	30
Acc. brake press systems	B	31
Brake press left & right	B	93
F/cont hyd fail & ind no 1, 2	B	268, 269
Flap lower solenoid	B	233
Flap position indic	B	45
Fluid contents	B	232
Flying cont no 1, 2 hyd fail	B	186, 187
Lift dumper control, ind	B	271, 272
Offload solenoid	B	132, 133
Pump no 1, 2 AC	B	4, 3
Pump no 1, 2 o/h & fail	B	129, 130
Pump standby	B	312
Syst no 1, 2 isol valve	B	235, 238
Syst no 1, 2 l/p warn	B	237, 240
Syst no 1, 2 o/heat	B	236, 239
Tail trim position ind	B	33
INSTRUMENTS		
Altimeter & alt alert left	RB	477
Altimeter left, right	B	270, 175
Flight recorder	RB	457
Flight recorder monitor	RA	408
No 2 (rh) servo altimeter	RB	478
OAT	B	174
S/b altimeter	B	220
S/b horizon	P	336

	PANEL	CB-FUSE
LIGHTS (EXTERNAL)		
Fin illumination	B	216
Flight insp left, right	B	153, 154
Landing lts left, cont, fil	B	114, 115
Landing lts right, cont, fil	B	116, 117
Landing lts nose	B	150
Navigation	P	334
Rot beacon mot upper, lower	B	118, 119
Rot beacon upper, lower	B	156, 157
Turn off left, right	B	151, 152
LIGHTS (FLIGHT DECK)		
Chart lights capt, f/o, ped	B	159, 160
Cockpit fluorescent	B	112
Compass & console	P	335
F/deck roof panel	B	221, 222
Inst integ lts, capts pnl	B	95
Inst integ lts, f/o, ctr pnls	B	64, 65
Inst pnl flood, ctr, left, right	B	308-310
Roof panel light	P	319
VHF/HF cont pnl lights	RA	425
VHF/HF cont pnl lights	RB	436
LIGHTS (PASSENGER SERVICES)		
Cabin & lav fluor left, right	B	83, 94
Call system	B	302
Emergency lts	B	243
Entrance & step	B	148
Ess cabin lts	B	307
Lavatory sign	B	161
Reading lts left, fwd, ctr, aft	B	137,139,141
Reading lts right, fwd, ctr, aft	B	136,138,140
Warning signs FSB, NS	B	134, 135
LIGHTS (CARGO & SERVICE COMP)		
Service	B	149
RADIO (SUPPLIES)		
Electronic DC no 1	B	184, 223
Electronic DC no 2	B	185
Elect pwr bus no 1 norm, s/by	B	13, 14
Elect pwr bus no 2 norm, s/by	B	15, 16
Essential c/o relay	RB	452
Essential electronics	B	295
Inst transformer no 1, 2	RB	450, 472
No 1, 2 26V bus	RB	482, 483
Radio supply warn light	RB	438
U/V detector	RB	486

	PANEL	CB-FUSE
RADIO (SYSTEMS)		
ADF no 1	RB	440
ADF no 2	RA	418
ATC transponder no 1, 2	RB	459, 473
Audio capts, f/o	RB	426, 427
DME no 1 AC	RB	461
DME no 1 DC	RA	404
DME no 2 AC	RB	476
DME no 2 DC	RA	419
Glideslope no 1	RB	431
Glideslope no 2	RA	417
GPWS AC	P	341
GPWS DC	RA	403
HF no 1 AC	RB	484
HF no 1 DC	RA	401
Marker	RA	402
Medina acc unit	RA	410
Medina unit	RB	469
Music rep	RA	414
Navigation c/o	RB	432
PA amp	RB	428
Radar AC	RB	463
Radar DC	RA	421
Radio alt inv	RA	420
Radio alt test	RA	409
Service interphone	B	224
VHF no 1	RB	429
VHF no 1 nav	RB	430
VHF no 2	RA	415
VHF no 2 nav	RA	416
Voice recorder	B	77
Voice recorder (inop)	B	181
STALL PROTECTION – WARNING (STICK SHAKE)		
Auto ign & stall warn no 1 vane ht	B	79
Auto ign & stall warn no 2 vane ht	B	87
STALL PROTECTION – IDENT (STICK PUSH)		
Stall ident no 1, 2 vante heat	B	70, 78
Stall ident no 1 sys cont & ind	B	218, 219
Stall ident no 2 sys cont & ind	B	206, 207
Stall ident sys fail ind	B	208
Stall protection no 1, 2 sys	P	332, 313
UNDERCARRIAGE		
Anti-skid outboard, inboard	B	281, 282
Anti-skid test	N	88
Landing gear indication	B	226
Landing gear lever lock	B	142
Landing gear relays left	B	283, 284
Landing gear relays right	B	285, 286
Landing gear warning	P	339
Standby steering l/p warn	B	273
Standby steering valve	B	131

AC DISTRIBUTION 539

	1 Main AC Bus	2Main AC Bus
Fuel;	booster pumps port tank fwd, starboard tank aft. 1 Top temp & dip ctrl.	booster pumps port tank aft, stbd tank fwd. 2 Top temp & dip ctrl
Hydraulics;	Aux pump 2	Aux pump 1. Foot brake press gauges. Anti-skid test
Anticing;	side & main windscreens port.	side & main windscreens starboard
	1 eng air press gauge	2 eng air press gauge
	Ice detector motor	Drain outlet
	Waste water pipes	Toilet water system
	Water system	
	1 Stall recovery vane	2 Stall rec vanes
	1 Stall warning & auto ign vane	2 Stall wrg & auto ign vanes
	Q Pitot port	Q Pilot stbd
Electrical;	Essential AC Bus normal	Galley load shed relay
	TRU 1	TRU 2
Air System;	Ground Conditioning Fan	2 Primary Temp Control
	Pressurisation control	
	Toilet fan	
	Flight deck temp control	Cabin temp control
	Radio cooling fan 1	Radio cooling fan 2
Galley 1;		Galley 1a and 2 Cockpit voice recorder
Lighting;	Flight deck flourescent	Anti-col beacon motors
	Cabin roof port	cabin roof starboard
	Toilet port	toilet starboard
	Instrument integral stbd & central panels.	instrument integral port panel
	Landing lamp control & filament port	Landing lamp control and filament starboard
FCS & Radio supplies;	See FCS & Radio	See FCS & Radio

Essential AC Bus

Fuel;	contents gauges
Engines;	Numbers 1 & 2 TVI, and 1 & 2 oil press gauges (transformers)
Air systems;	Number 1 Primary Temp Control Valve.
Hydraulics;	hyd acc press gauge, brake acc press gauge, Hand brake press gauge (transformer)
Fire detect;	Engine fire detect & zones 1 & 2 overheat. APU fire detect
Flt controls;	Flap position indicators (transformers) Elevator trim tab indicator (transformer Tail trim position indicator
Radio supplies	(See FCS & Radio section)

DC DISTRIBUTION

MAIN DC BUS BAR

Fuel;	Flowmeters 1 & 2. LP w/lts eng & booster. Fuel Temp gauge. Top temp & dip ctrl.
Engines;	igniter 2 (both engines)
Anticing;	pitot heaters stbd. System 2 wing & tail valves. Eng 1 & 2 stbd valves. System 2 duct pressure gauge. Windscreen u'heat w/lts. Overheat control & w/lts. Visual ice detector heater. Drain mast heater. Crossfeed valve control.
Air Cond;	Fan (ground) control. 2 TCV position ind & 2MV duct & CAU w/lts. Main temp ind. Cabin temp ind. Sustem 2 isolation valve & system fail w/lt. Heat exchanger outlet shutter. Crossfeed valve control.
Electrical;	Main DC sub bus bar. DC essential fail w/light.
Hydraulics;	Standby steering valve solenoid. Aux pump motor overheat w/lts. Off load solenoid.
Lights;	Nose landing. Turn-off. Anti-collision. Entrance & step. Flight Deck chart P1 & 2. Service. Passenger reading & notices. Door warning. Ice inspection port & stbd. Pedestal flood. Fin.

Flying Ctrls;	Stall rec controls & indicators No 2 system. Stall Rec fail indicator. Spoiler fail MI's
Others;	High speed warning 1 & 2. Mach trim lamp. OAT gauge. Cockpit Voice Recorder. Radio cooling fan fail w/lt. Domestic water level w/lt & chlorine test. Stbd altimeter PE flag. Stbd alt alert hooter.

MAIN DC SUB BUS

Stall prot system 2. DC u/volt detector amplifier

ESSENTIAL DC BUS BAR

Fuel;	LP warning lights 1 & 2 system. Refuel Control. Defuel valve and indicator.
Engines;	Thrust reverser unlocked lights. Oil temp gauges. Oil LP w/lts. Start relays. CSD disconnect. Fire & Overheat zone 1 & 2 w/lts. Fire bottle discharge indicators.
Anticing;	System 1 wing & tail valves. Engine 1 & 2 port valves. System 1 duct pressure gauge. Ice detector. Wing and Tail MI,s. Air crossfeed indicator.
Electrical;	Elect Ess sub bus bar. W/Lts test. Generator fail w/lts. Standby inverter. Bus fail w/lts. Battery & Inverter MI's. Main DC bus isolation relay coil
Air Cond;	fuse duct fail w/lt. 1 & 2 Isol valves & system fail w/lts. 1 TCV posn & MV inds. 1 MV Duct & CAU overheat w/lt. Discharge valve indicator. Safety valve. Ram air valve. Cabin alt w/lt. Air crossfeed indicator.
Flying Ctrls;	Servo fail w/lts. Servo power MI's. Lift dump control & MI's. Tail trim position indicator. Emergency elevator control. Stall Rec system 1 controls and indicators. Flap lower solenoid. Rudder feel fail.
Hydraulics;	Fluid contents gauge. Isolation valves. Fluid overheat lights. Pressure LP w/lts. Landing Gear position lights. Standby steering w/lt. Anti-skid system.

Lights; Cabin essential. Instrument panel flood. Steward call. Red and white floods. Roof panel. 1 & 2 Emergency systems. Floor proximity lighting transmitters.

APU; Fuel pump. Generator fail w/lt. Generator control.

Others; Service intercom. Oleo switches. Standby altimeter vibrator. Port altimeter PE flag. Altitude alert system, including test and port hooter.

ESSENTIAL DC SUB BUS BAR

Fuel LP cocks. Fuel Crossfeed cock MI. Engine Fire bottles 1st shot. Both engines igniter 1. Compass, console & nav lights. APU fuel valve. APU Fire detector. Fire bell. Stall protection system 1. Pitot heater port. Configuration & Gear warning. Standby Horizon.

Battery Bus Bar	Battery Sub Bus Bar
Battery sub bus bar	Eng fire bottles 2nd shot
APU start & ctrl	APU fire bottle
Hyd DC pump	Flight deck roof light

FCS & RADIO POWER SUPPLIES & COOLING

GENERAL. The FCS and all radio systems power supplies are automatically fed, via the cb's on panel B, from the aircraft bus bars to the Radio and Electronic Bus Bars, of which there are three DC and three AC. There are no master switches controlling the supplies to these. Supplies to the individual systems or units, are taken from the R & E Bus Bars via the cb's on Panels RA and RB.

AC SUPPLIES. Fig. 1 shows the AC supply circuits; the 115V and 26V distribution lists are shown separately.

The Radio and Electronic AC Bus Bars 1 & 2 are normally fed from 1 Main AC Bus Bar through two normally energised R & E AC Bus Relays. The

cont/...

coils of these relays are energised, from 1 Main AC Bus, only when its voltage and frequency are within certain limits, and the SSB is open. When the R & E AC Bus Relays are relaxed, supplies for the R & E AC Bus Bars are taken from 2 Main AC Bus Bar.

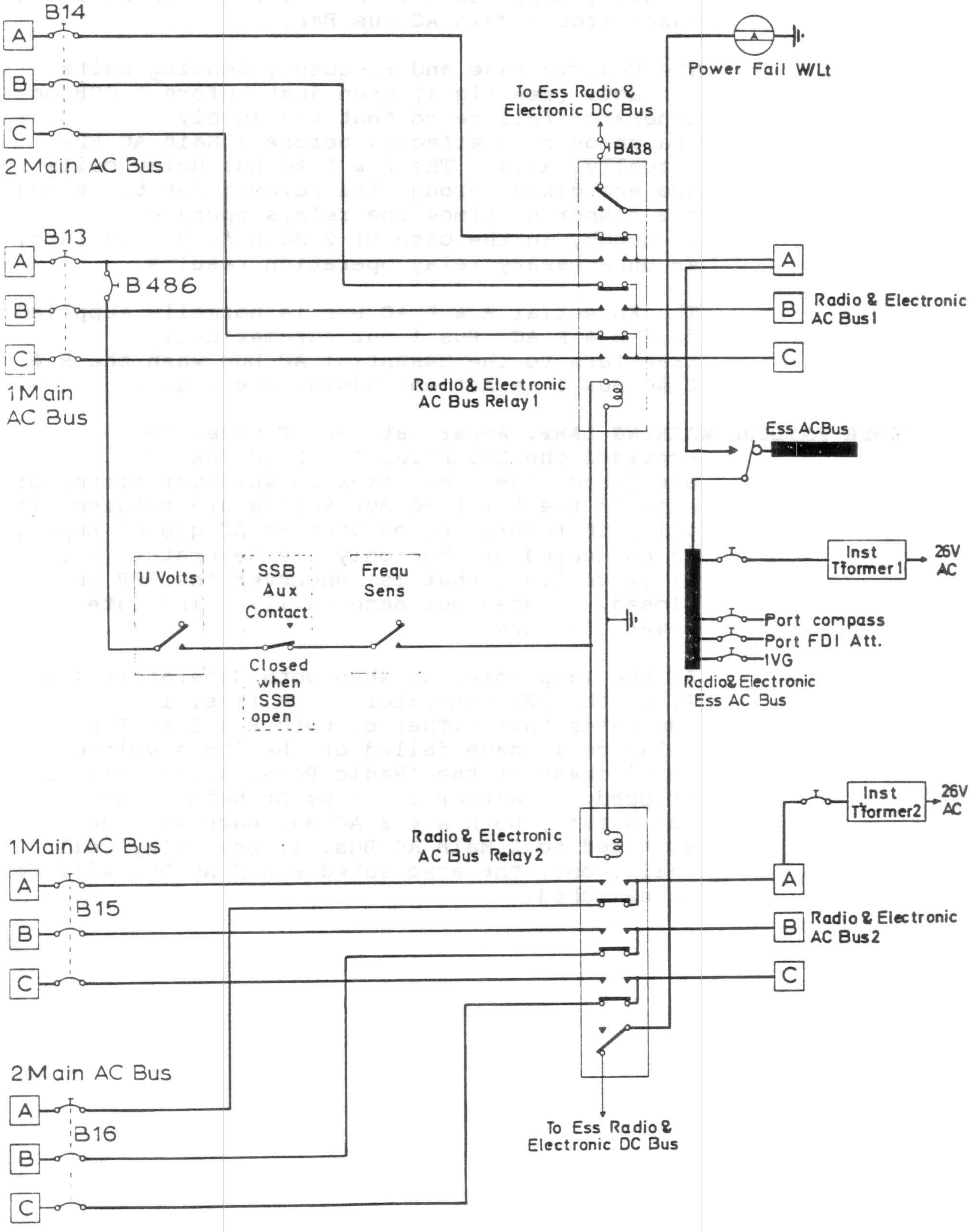
The Undervoltage and Frequency Sensing units contacts (see Fig.1) open just before 1 GCB on generator failure so that the supply change-over is effected before 1 Main AC Bus actually fails. The R & E AC Bus Relay coils are energised through the relaxed SSB to reduce the number of times the relays operate, although, in the case of 2 Main AC Bus failure, an unnecessary relay operation results.

The Essential R & E AC Bus is normally supplied from R & E AC Bus 1 but automatically transfers to the Essential AC Bus when the R & E AC Bus 1 is not energised. See Fig.1.

POWER FAILURE WARNING LAMP. Amber, at top of panel RB. Provided the Essential R & E DC Bus is energised, the lamp comes on whenever either or both of the R & E AC Bus Relays are relaxed. It will, therefore, be on when an AC ground supply is connected or when only one Generator (1 or 2) is on line; that is, whenever the SSB is closed. It does not necessarily indicate power failure.

If the lamp comes on when both Generators 1 & 2, or the APU Generator is on line, it indicates that either or both R & E AC Bus Relay coils have failed or the 'Undervoltage Unit' cb486 or the 'Radio Power No.1' cb13 is tripped. If either cb trips or both relay coils fail, both R & E AC Bus Bars will be switched to 2 Main AC Bus. If one relay coil fails, only the associated R & E AC Bus will be so switched.

FIGURE 1 RADIO AC DISTRIBUTION



RADIO & ELECTRONIC AC BUS BAR DISTRIBUTION

	R & E Bus 1		R & E Bus 2
	Autopilot		Stbd Compass
P	Port Course Ind	P	Stbd Compass Ind
h	Port FCS Attitude	h	Stbd FDI Attitude
a	Port FCS Command	a	Stbd FCS Command
s	Air Data Sensor	s	Medina Unit
e	Flight Recorder	e	Vertical Gyro 2
	HF Coms		W Radar
A	Essential R & E Bus (norm)	A	Inst Transformer 2
	AC Ess C/O relay		26V
	GPWS & BRC		
P	Autopilot		Rel Brg Pointers 2
h	HF Coms		ADF 2
B	Transponder 1		NAV 2
			Stbd Altimeter
		Ph.B	Transponder 2
P	Autopilot		
h	HF Coms	Ph.C	DME 2
C	DME 1		

ESSENTIAL R & E BUS

Port Compass Indicator
Port FDI Attitude
Vertical Gyro 1
Inst Transformer 1
26V
Rel. Brg. Pointers 1
ADF 1
NAV 1
Port Altimeter
Alt Alert Unit

DC SUPPLIES. Fig.2 shows the 28V DC supply circuits and distribution. R & E DC Bus 1 is normally supplied from the Essential DC Bus but is automatically transferred to the Main DC Bus if undervoltage is detected on 1 & 2 AC Main Bus Bars.

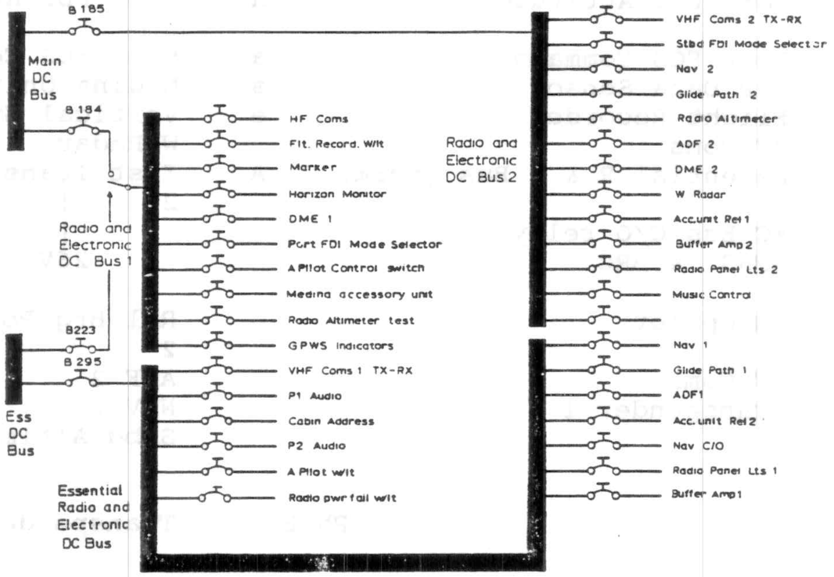
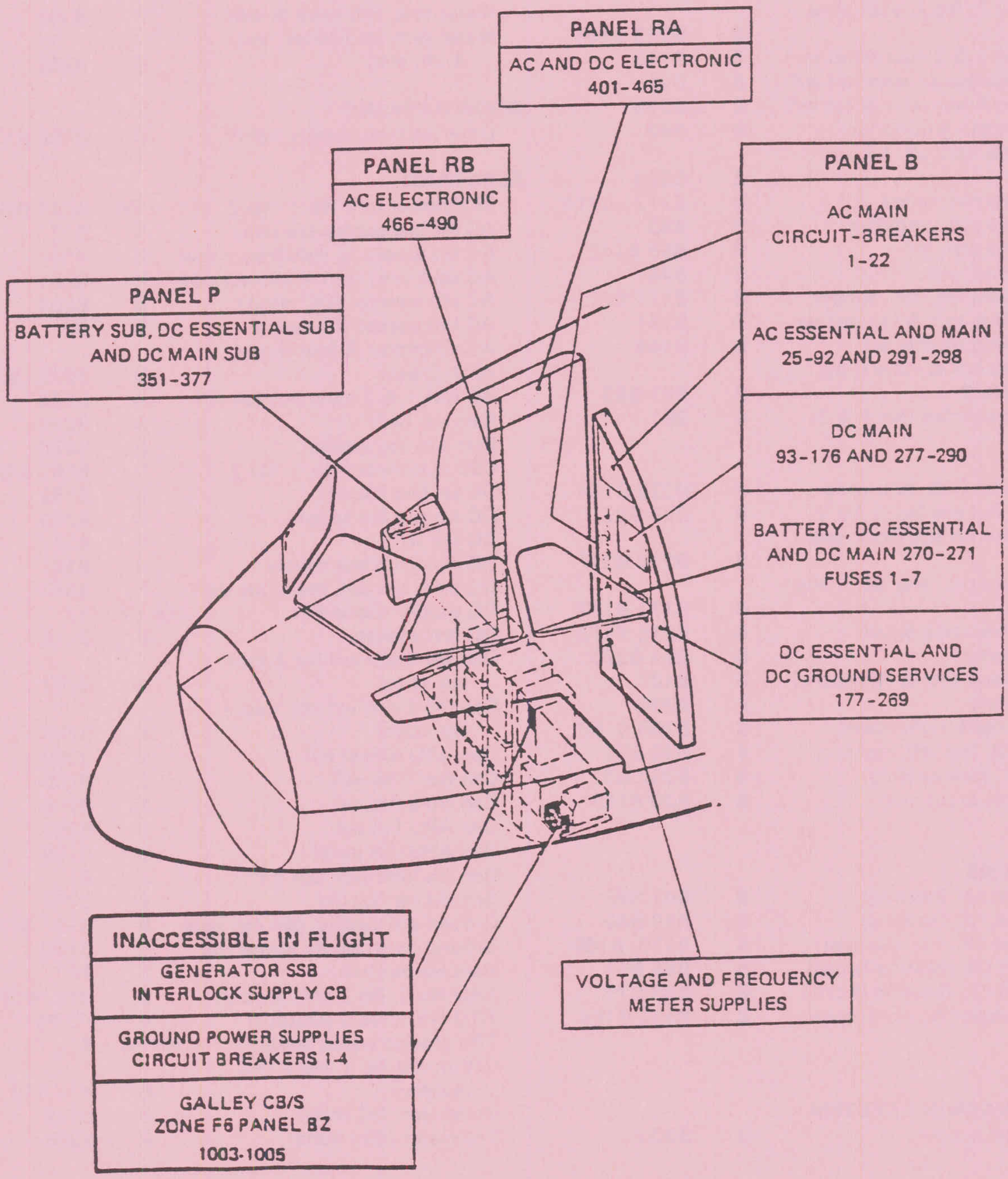


FIGURE 2 - RADIO DC DISTRIBUTION

RADIO COOLING FANS SWITCH. Marked 'No.1-OFF-No.2', on the roof panel, this switch controls the supply to the fan motors. The fans draw cooling air through the flight dock and electronics bay racks.

FAN FAIL WARNING LAMP. Amber, on the roof panel. Provided the DC Main Bus is energised, the lamp comes on when the Radio Cooling Fans switch is off, or in the event of motor failure or serious underspeeding of the selected fan. In the latter case, the alternative fan should be selected, which will put the light off.

ELECTRICAL DISTRIBUTION 510
FUSE AND CIRCUIT BREAKER LIST



FUSE & CIRCUIT BREAKER LOCATION CHART

	PANEL	CB-FUSE
AIR CONDITIONING		
Air sys No. 1, air cond	B	B135
Air sys No. 1 RCV pos & MV duct & CAU o/heat	B	B219
Air sys No 2 TCV pos & MV duct & CAU o/heat	B	B146
Air sys No 2 isol valve & sys w/l	B	B145 B210
Air sys No 1, No 2, duct press. inds.	B	B225 B164
Air sys No 1 & 2 duct temp in.	B	B143
Air sys fuselage air duct fail w/l	B	B211
Air sys No 1 isol valve & sys w/l	B	B218
Air temp ctrl - ground test	B	B50
Cabin press. ctrl. alt. sw & w/l	B	B220
Cabin press rtrl, valves	B	B212 - B214
Cabin press ctrl, amplifier	B	B53
Cabin temp ctrl, ind	B	B56 B142
F/deck temp. ctrl.	B	B48
Grnd cooling fan, ctrl, supply	B	B174 B21
Grnd cooling m/v & fan ctrl sw	B	B141
Grnd cooling shutter act.	B	B144
Prim. temp ctrl & valve supp. No 1, No 2	B	B47 B55
Toilet exhaust fan (No 1 & 2)	B	B81
ANTICING		
Air foil temp inds, tail, wing	B	B225 B164
Air press. ind eng No 1, No 2	B	B79 B87
Antice valve l.h.eng No 1, eng No 2	B	B216 B217
Antice valve r.h., eng No 1, eng No 2	B	B171 B172
Antice valve, wing & tail	B	B215 B173
Ice det. motor	B	B64 B226
Ice det. visual (htr & lt. supply)	B	B107
Pitot htr, left	P	B369
Pitot htr, right, right lower	B	B109 B150
Pitot htr, 0. feel left, right	B	B49 B57
Water syst, pipe heating	B	B292 B52
Water waste drain mast	B	B70 B155
WINDSCREENS		
Mainscreen l.h. (heating)	B	B82 B66
Mainscreen r.h. (heating)	B	B59 B89
Mainscreen l.h., r.h. (control)	B	B170, B169
Sidescreen l.h. (heating & ctrl)	B	B65 B51
Sidescreen r.h. (heating & ctrl)	B	B58 B72
Rain repellent l.h., r.h. (power)	B	B153 B154
CENTRAL WARNING SYSTEM		
W/light test supply	B	B200

	PANEL	CB-FUSE
DOMESTIC SERVICES		
Galley load shed	B	B88
Galley relay (ZN F6)	BZ	1003-1005
Galley supply No. 1	B	B19
Galley supply No. 2	B	B20 B22
Galley supply No. 3	B	B1
Toilet water heater	B	B73
Water syst. (fill valve & ind)	P	B359
Water syst. (hi-low lev. ind & ch. test)	P	B282
DOOR WARNING		
Door warning, supply lights	B	B168 B176
ELECTRICS		
15V power unit No 1. No 2	RA	B447 B459
AC ess bus supply c/o relay	B	B77
AC ess supply to volt/freq. meter	B	B43
AC split syst. (ctrl & protection)	P	B361
AC s/b inverter (DC input)	B	B253
AC test socket (flt deck)	B	B2
AC voltmeter & freq meter, 1, APU, 2 gen.	B	B272 - B274
AC Nos 1 & 2 main bus tail w/l	B	B248
Batt ind (w/l)	B	B246
Batt sub bus supply	B	B270
CSD disconnect No 1, No 2	P	B362 B363
DC ess bus fail w/l	B	B162
DC ess sub bus supply	B	B249
DC fail w/l	B	B247
DC main sub bus supply	B	B161
DC split, u/v det, main bus iol	P	B353
DC supply (Zone F4)	Zn F4	B2
DC test sockets	B	B148
Gen No 1 o/h w/l No 2 cool. (air valve)	B	B257
Gen No 2 o+n w/l No 1 cool. (air valve)	B	B258
Gen APU o/heat w/l	B	B262
Gen No 1 fail w/l	B	B255
Gen No 2 fail w/l	B	B256
Gen APU fail w/l	B	B264
Gen APU ctrl panel	B	B179
Gen ssb interlock (Zn F4)	J	B1
Ground ctrl supply	B	B251
Ground ctrl supply, gen ctrl pnls	B	B177 B178
Ground ctrol supply power ind	B	B180
Main-ess bus link	B	F4
TRU No 1, No 2 (AC supply)	B	B17, B18
TRU No 1, No 2 (Output)	B	F3 F5
TRu ground power supply	Zn F4	B1
U/Volt det No 1, No 2 (AC (supply)	B	B11 B12
Voltmeter (DC volts)	B	B149
Voltmeter (Batt volts)	P	B358

ENGINES (NOS. 1 & 2)

Air cross valve (ctrl & ind.)	B	B163
CSD control	P	B362 B363
Firebell (DC supply)	P	B371
Fire bottle ind.	B	B233
Fire det. (unit supply)	B	B36 B37
Fire det. (eng det & test supply)	B	B234 B237
Fire ext (op. supply)	P	B354 B355
Ign No 1 (No 1 eng), (No 2 eng)	P	B364 B365
Ign No 2 (No 1 eng), (No 2 eng)	B	B112 B113
Oil press l.p. warn	B	B221 B222
Oil press inds	B	B44 B45
Oil temp.	B	B223 B224
O/heat ctrl box DC supply	B	B235 B238
O/heat ctrl box AC supply	B	B37 B39
O/heat ind & test supply	B	B236 B239
Start master ctrl (DC supply)	B	B250
Thrust rev u/lock w/l	B	B187 B188
Vibration inds	B	B34 B35

ENGINES (APU)

Eng. ctrl c/feed valve ind	B	B263
Fire det. amp. supply	N	B40
Fire det. & test supply	P	B376
Fire ext (ctrl)	P	B356
Fuel pump	B	B261
Fuel valve	P	B375
Ground power (DC supply)	Zn F4	B4
Start & control	B	F1

FLIGHT CONTROL SYSTEM (F.C.S.)

Air data	RA	B444
Attitude amp. & v/gyro (syst 1, 2)	RB	B468 B479
Attitude command (syst 1, 2)	RB	B477 B478
Attitude comparator AC	RB	B476
Attitude comparator DC	RA	B410
A/P	RB	B470
A/P i/lock monitor	RA	B451
A/P mode switching	RA	B413
A/P mode indication	RA	B421
A/P w/l (supply)	RA	B411
Autothrottle	RA	B445
Comp. cross-comparator	RA	B409
Comp. syst 1, amp.	RB	B467 B466
Comp. syst 2, amp	RB	B475 B474
High speed warn system 1, 2	B	B277 B278
Inst t/form No 1, No 2	RA	B446 B454
Integrated flight syst (test)	RA	B423
Interlock fail monitor disp. panel	RA	B441
Mach trim AC, DC supply	RA	B464 B426
Mode switching (A/P & Flt. dir.)	RA	B419
Steer computer (AC supply)	RA	B453
V/Gyro No 1, No 2, buffer amp.	RA	B422 B435
V/Gyro No 3 (supply)	RA	B455

FLYING CONTROLS

Ctrl fail syst. 1, 2 (hyd fail)	B	B159 B160
Elev. trim tab posn. ind.	B	B25
Flap overspeed warn.	B	B119
Flap posn. ind.	B	B42
Lift dumper, ind, supply	B	B231, B230
Rudder feel fail w/l	B	B185
S/b elev. trim ctrl.	B	B186
Spoiler syst No 1, No 2	B	B227 B228
Tail trim posn. ind.	B	B229

FUEL

Booster (transfer) pumps centre	B	B7 B8
Booster pumps l.h. wing, fwd, aft	B	B5 B6
Booster pumps r.h. wing, fwd, aft	B	B10 B9
Contents, l.h., r.h., centre tanks	B	B31 B33 B32
Eng fuel flow inds, l.h., r.h.	B	B93 B94
Eng l.p., l.h., r.h. w/lights	B	B208 B209
L.p. valve ctrl & inds l.h., r.h.	P	B366 B368
L.p. valve ctrl & ind crossfeed	P	B367
L.p. w/l boost pump l.h., r.h.	B	B204 B205
L.p. w/l centre transfer pump	B	B206
Refuel master ctrl.	B	B207
Refuel transfer valve l.h., r.h.	B	B97 B98
Temp. ind l.h. & r.h.	B	B101
Top temp & dip ctrl (lh amp & valve)	B	B63
Top temp & dip ctrl (rh amp & valve)	B	B71
Top temp & dip ctrl (lh td & ctrl)	B	B99
Top temp & dip ctrl (rh td & ctrl)	B	B100

HYDRAULICS

Acc. press inds, brakes, systs.	B	B27 B28
Brake pressure l.h. & r.h.	B	B90
Flap lower sol.	B	B192
Fluid contents (lh & rh tanks)	B	B191
S/b brake press. ind.	B	B193
S/b pump No 1, No 2 AC	B	B4 B3
S/b pump (brake & airstairs)	B	B271
S/b steering acc. l.p. w/l	B	B232
Syst 1, 2, aux pump o/heat	B	B102 B103
Syst 1, 2, isol. valve ind	B	B194 B197
Syst 1, 2, lp w/l	B	B196 B199
Syst 1, 2, offload sol.	B	B105 B106
Syst 1, 2, o/heat	B	B195 B198

INSTRUMENTS

Alt (servo No 1, No 2 syst)	B	B30 B92
Flt. rec. (ctrl & proc)	RA	B443
Flt. rec (parameter supplies)	B	B118
Flt. rec (stall protection)	RF	F923
FL 100 w/l (No 1 & 2)	B	B252
OAT	B	B147
S/b gyro horizon	B	B26
Turn & slip inds No 1, No 2	B	B41 B68

LIGHTS (EXTERNAL)

Anti-coil lt. upper, lower	B	B129 B134
Anti-coil motor, upper, lower	B	B297 B298
Ice det, l.h., r.h.	B	B126 B127
Landing lt. nose	B	B167
Landing lt. l.h., fil, act.	B	B294 B293
Landing lt. r.h., fil, act.	B	B296 B295
Navigation	P	B360
Servicing	B	B128
Servicing (gnd pwr supply)	B	B181
Turn off, lh, rh.	B	B124 B125

LIGHTS (FLIGHT DECK)

Chart (capt)	B	B122
Compass (ctr) & map table (capt, f/o)	P	B373
Fluor. lighting (storm lts)	B	B291
Panels (red & white flood)	B	B267 - B269
Panel inst (left, ctr, right)	B	B130 - B133
Panel inst (roof)	B	B259 B260
Red & white flood & f/o chart	B	B123
Roof light	P	B357
Radio panel lights No 1, No 2	RA	B408 B434

LIGHTS (PASSENGER SERVICES)

Cabin roof (fluorescent) l.h., r.h.	B	B80 B91
Cabin roof (ess. DC)	B	B266
Call system (crew & toilet)	B	B265
Emergency lights (sys 1, 2)	B	B201-B202
Entrance/steps	B	B121
Reading lts l.h. (fwd, aft)	B	B138 B140
Reading lts r.h. (fwd, aft)	B	B137 B139
Toilets lts l.h., r.h.	B	B80 B91
Warning signs (supply)	B	B136

RADIO (SUPPLIES)

AC supply No 1 syst.	B	B13 B14
AC supply No 2 syst.	B	B15 B16
AC supply essential	B	B29
DC supply No 1, No 2 syst.	B	B157 B158
DC supply essential	B	B254
Radio/Electronic pwr/fail w/l	RA	B404
Radio supply undervolt det.	RB	B489

RADIO (SYSTEMS).

ADF No 1, 2 RX	RA	B402 B428
ADF/VOR (C/O) No 1, 2	RA	B412 B425
ATC 1 & 2 Tx/Rx) Pre Mod	RA	B415
ATC 1, 2 TX/Rx) 34C334	J/B	F1 F2
Transponder No.1) Post Mod	RA	B452
Transponder No.2) 34C334	RA	B465
C/A	RA	B403
CCE & Service interphone	RA	B406
CCE	RA	B432
Deviation comparator	RB	B481
DME No 1, 2 syst (AC supply)	RA	B449 B463
DME ind & rack cooling fan w/l	RA	B405
GP-1 (glidepath)	RA	B418
GP-2 (glidepath)	RA	B431
GPWS (AC)	RB	B483
GPWS (DC)	RA	B442
Marker No 1, 2 (DC supply)	RA	B416 B429
Mode ind (sw. unit supply)	RA	B421
Mode switching	RA	B419
Nav. Rx VHF No 1, 2 (DC)	RA	B417 B430
Rack cooling fan No 1, 2	RA	B448 B460
Rack cool. fan fail w/l & DME	RA	B405
Radio altimeter	RA	B450
Radio altimeter ground test	RA	B440
Radio selector switch No 1, 2	RB	B469 B480
Service interphone & CCE	RA	B406
VHF 1 Tx-Rx	RA	B401
VHF 2 Tx-Rx	RA	B427
VHF 3 Tx-Rx	RA	B414
Voice recorder AC, DC	B	B60 B190
Weather Radar AC	RN	B482
Weather Radar DC	RA	B436

STALL PROTECTION-WARNING (STICK SHAKE)

Stall warn. (auto ign. No 1) vane heat	B	B76
Stall warn. (auto ign. No 2) vane heat	B	B84
Stall warn. No 1. sys.	P	B370
Stall warn. No 2 sys.	P	B351

STALL PROTECTION - IDENT. (STICK PUSH)

Stall ident No 1 ctrl & htr fail ind.	B	B184
Stall ident No 1 hp ind & stall op w/l	B	B183
Stall ident No 2 ctrl & htr fail ind.	B	B166
Stall ident No 2 hp ind & stall op w/l	B	B165
Stall ident No 1 vane heat stn 336L	B	B67
Stall ident No 2 vane heat stn 336R	B	B75
Stall ident l.p. warn & fail ind.	B	B152

UNDERCARRIAGE

Anti-skid (test)	B	B85
Anti-skid syst. supply l.h., r.h.	B	B240 B241
Hyd. s/b steering valve	B	B104
Hyd. s/b steering l.p. w/l	B	B232
Land. gear cont. serv. (rel) l.h.	B	B242 B243
Land. gear cont. serv. (rel) r.h.	B	B244 B245
Land. gear sel. lever lock	B	B115
Land. gear unlock warn.	P	B377
Land. gear w/l (ind)	B	B203

AC DISTRIBUTION 510

	1 Main AC Bus	2Main AC Bus
Fuel;	booster pumps port tank fwd, starboard tank aft.	booster pumps port tank aft, stbd tank fwd.
	1 Top temp ctrl.	2 Top temp ctrl
	Centre tank Port transfer pump.	Centre tank stbd transfer pump
Hydraulics;	Aux pump 2	Aux pump 1. Foot brake press gauges. Anti-skid test
Anticing;	side & main windscreens port.	side & main windscreens starboard
	1 eng air press gauge	2 eng air press gauge
	Ice detector motor	Drain outlet
	Waste water pipes	Toilet water system
	Water system	
	1 Stall recovery vane	2 Stall rec vanes
	1 Stall warning & auto ign vane	2 Stall wrg & auto ign vanes
	Q Pitot port	Q Pilot stbd
Electrical;	Essential AC Bus normal	Galley load shed relay
	TRU 1	TRU 2
Air System;	Ground Conditioning Fan	2 Primary Temp Control
	Pressurisation control	
	Toilet fan	
	Flight deck temp control	Cabin temp control
	Radio cooling fan 1	Radio cooling fan 2
	1 Primary TCV	
Galley 1		Galley 1a and 2
Cockpit Voice recorder		
Lighting;	Flight deck flourescent	Anti-col beacon motors
	Cabin roof port	cabin roof starboard
	Toilet port	toilet starboard
	Landing lamp control & filament port	Landing lamp control and filament starboard
FCS & Radio supplies;	See FCS & Radio	See FCS & Radio

Essential AC Bus

Fuel;	contents gauges
Engines;	Numbers 1 & 2 TVI, and 1 & 2 oil press gauges (transformers). Overheat control.
Hydraulics;	hyd press gauge, brake acc press gauge.
Fire detect;	Engine fire detect & zones 1 & 2 overheat. APU fire detect
Flt controls;	Flap position indicators (transformers) Elevator trim tab indicator (transformer
Instruments;	Port altimeter, port turn & slip, standby horizon.
Radio supplies	(See FCS & Radio section)

DC DISTRIBUTION

MAIN DC BUS BAR

Fuel;	Flowmeters 1 & 2. LP w/lts eng & booster. Fuel Temp gauge. Fuel transfer valves. Top temp control.
Engines;	igniter 2 (both engines)
Anticing;	pitot heaters stbd. System 2 wing & tail valves. Eng 1 & 2 stbd valves. System 2 duct pressure gauge. Windscreen u'heat w/lts. Overheat control & w/lts. Visual ice detector heater. Drain mast heater. Crossfeed valve control. Wing antice temp indicator.
Air Cond;	Fan (ground) control. 2 TCV position ind. 2MV duct & CAU w/lts. Main temp ind. Cabin temp ind. Sustem 2 isolation valve & system fail w/lt. Heat exchanger outlet shutter. Crossfeed valve control.
Electrical;	Main DC sub bus bar. DC fail w/light. Bus Isolating relay. Test sockets.
Hydraulics;	Standby steering valve solenoid. Aux pump motor overheat w/lts. Off load solenoid.

Lights;	Nose and wing landing. Turn-off. Anti-collision. Entrance & step. Flight Deck chart P1 & 2. Instrument pillar lights. Service. Passenger reading & notices. Door warning. Ice inspection port & stbd.
Flying Ctrls;	Stall rec controls & indicators No 2 system. Spoiler fail lights.
Others;	High speed warning 1 & 2. OAT gauge. Domestic water level w/lt & chlorine test. Flap overspeed w/light. Landing gear lever lock system.

MAIN DC SUB BUS

Stall prot system 2. DC u/volt detector amplifier

ESSENTIAL DC BUS BAR

Fuel;	LP warning lights 1 & 2 system. Refuel Control. Transfer LP w/light.
Engines;	Thrust reverser unlocked lights. Oil temp gauges. Oil LP w/lts. Start relays. Fire & Overheat zone 1 & 2 w/lts. Fire bottle discharge indicators.
Anticing;	System 1 wing & tail valves. Engine 1 & 2 port valves. System 1 duct pressure gauge. Ice detector. Tail antice temp indicator. Air crossfeed indicator.
Electrical;	Elect Ess sub bus bar. W/Lts test. Generator fail w/lts. Standby inverter. Bus fail w/lts. Battery isolated w/light. Ground power control. Main DC bus isolation relay coil.
Air Cond;	fuse duct fail w/lt. 1 & 2 Isol valves & system fail w/lts. 1 TCV posn & MV inds. 1 MV Duct & CAU overheat w/lt. Discharge valve indicator. Safety valve. Ram air valve. Cabin alt w/lt. Air crossfeed indicator. Galley fan
Flying Ctrls;	Servo fail w/lts. Servo power MI's. Lift dump control & MI's. Tail trim position indicator. Emergency elevator control. Stall Rec system 1 controls and indicators. Flap lower solenoid.

Hydraulics;	Fluid contents gauge. Isolation valves. Fluid overheat lights. Pressure LP w/lts. Landing Gear position lights. Standby steering w/lt. Anti-skid system. Handbrake pressure gauge.
Lights;	Cabin essential. Instrument panel flood. Steward call. Red and white floods. Roof panel. 1 & 2 Emergency systems. Floor proximity lighting transmitters.
APU;	Fuel pump. Generator fail w/lt. Generator control.
Others;	FL 100 lamps. Landing gear lever lock system. CVR amplifier and relays.

ESSENTIAL DC SUB BUS BAR

Fuel LP cocks. Fuel Crossfeed cock MI. Engine Fire bottles 1st shot. Both engines igniter 1. CSDS disconnect. Compass and console lights. APU fuel valve. APU Fire detector. Fire bell. Stall protection system 1. Pitot heater port. Configuration & Gear warning.

Battery Bus Bar	Battery Sub Bus Bar
Battery sub bus bar	Eng fire bottles 2nd shot
APU start & ctrl	APU fire bottle
Hyd DC pump	Flight deck roof light
Nav lights	Service intercom
	Water system fill valve

FCS & RADIO POWER SUPPLIES & COOLING

GENERAL. The FCS and all radio systems power supplies are automatically fed, via the cb's on panel B, from the aircraft bus bars to the Radio and Electronic Bus Bars, of which there are three DC and two AC. There are no master switches controlling the supplies to these. Supplies to the individual systems or units, are taken from the R & E Bus Bars via the cb's on Panels RA and RB.

AC SUPPLIES. Fig. 1 shows the AC supply circuits; the 115V and 26V distribution lists are shown separately. The Radio and Electronic AC Bus Bars 1 & 2 are normally fed from 1 Main AC Bus Bar through two

cont/...

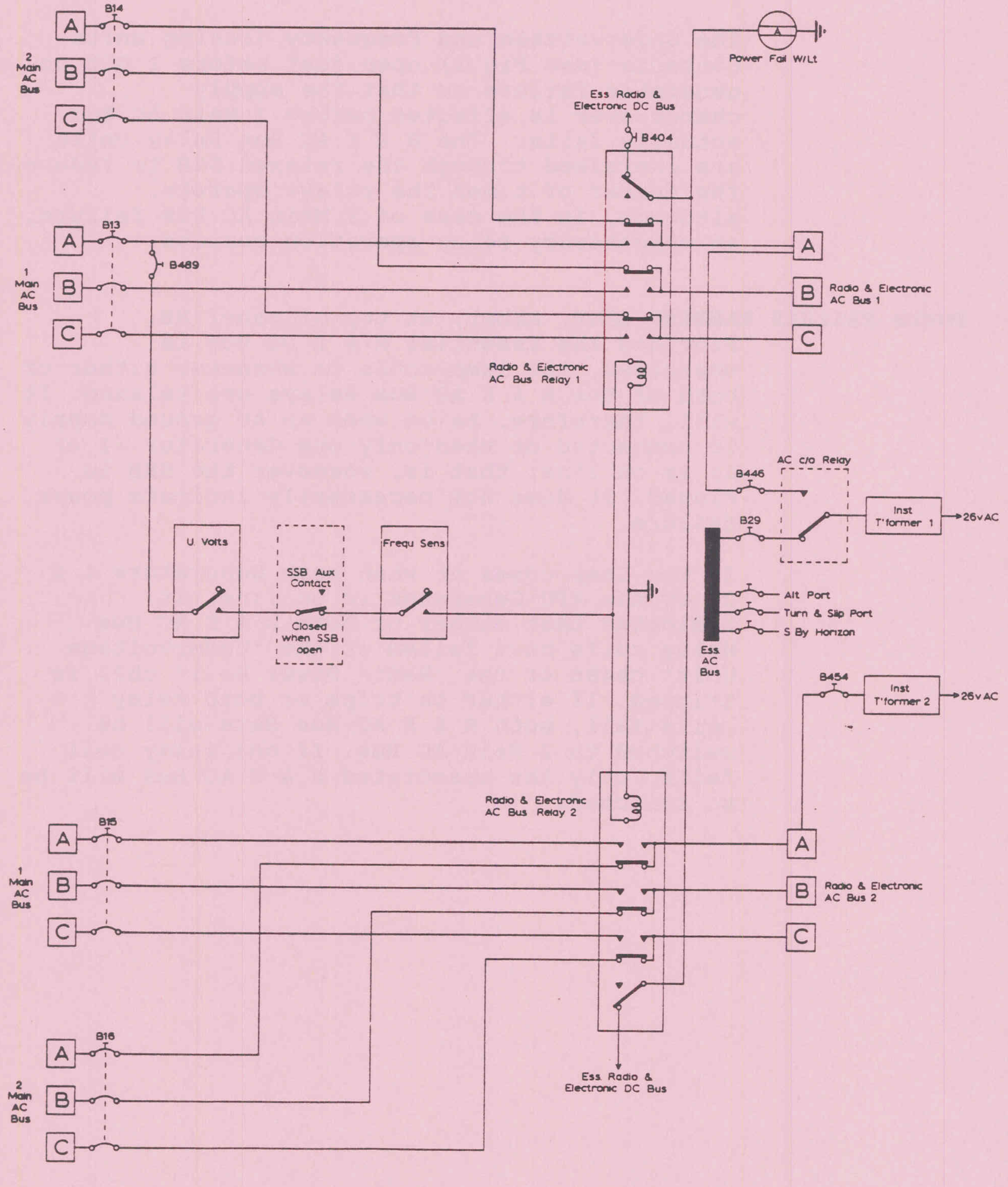
normally energised R & E AC Bus Relays. The coils of these relays are energised, from 1 Main AC Bus, only when its voltage and frequency are within certain limits, and the SSB is open. When the R & E AC Bus Relays are relaxed, supplies for the R & E AC Bus Bars are taken from 2 Main AC Bus Bar.

The Undervoltage and Frequency Sensing units contacts (see Fig.1) open just before 1 GCB on generator failure so that the supply change-over is effected before 1 Main AC Bus actually fails. The R & E AC Bus Relay coils are energised through the relaxed SSB to reduce the number of times the relays operate, although, in the case of 2 Main AC Bus failure, an unnecessary relay operation results.

POWER FAILURE WARNING LAMP. Amber, at top of panel RB. Provided the Essential R & E DC Bus is energised, the lamp comes on whenever either or both of the R & E AC Bus Relays are relaxed. It will, therefore, be on when an AC ground supply is connected or when only one Generator (1 or 2) is on line; that is, whenever the SSB is closed. It does not necessarily indicate power failure.

If the lamp comes on when both Generators 1 & 2, or the APU Generator is on line, it indicates that either or both R & E AC Bus Relay coils have failed or the 'Undervoltage Unit' cb486 or the 'Radio Power No.1' cb13 is tripped. If either cb trips or both relay coils fail, both R & E AC Bus Bars will be switched to 2 Main AC Bus. If one relay coil fails, only the associated R & E AC Bus will be so switched.

FIGURE 1 RADIO AC DISTRIBUTION



RADIO & ELECTRONIC AC BUS BAR DISTRIBUTION

R & E Bus 1

Phase A

Autopilot
Port Att Amp
Port compass display
Port compass amp
Port Master Comp unit
1 Vertical Gyro
1 Directional Gyro
ADC
Autothrottle
Flt Rec orders
1 Radio Switch unit A

Inst Tranformer 1
|
26V
|
Compasses
ADF 1
NAV 1
RMI cards & red pointers

Phase B

Autopilot
Port Att Amp
Port Compass display
Port Compass amp
Port Master Comp unit
Radio cooling fan 1
1 Radio Switch unit A

Phase C

Autopilot
Port Att Amp
Port Compass Amp
Port Master Comp unit
Compass Comparator
IF Monitor
Rad Alt
1 DME
GPWS & Bar Rate Comp.

R & E Bus 2

Phase A

Att Comparator
Stbd Att amp
Stbd compass display
Stbd compass amp
Stbd Master Com unit
Vertical Gyro 2 & 3
2 Directional gyro
P & S Flt Dir amps
Interface modulator
Steering computer
Radio Devn Compar
Wx Radar
2 Rad switch unit A
Radio switch unit C

Inst transformer 2
|
26V
|
Compasses
ADF 2
NAV 2
RMI green pointers
FCS mode switch
Flt Recorders

Phase B

Attitude Comparator
Stbd Att Amp
Stbd Compass display
Stbd Compass amp
Stbd Master Com unit
Radio cooling fan 2
Interface modulator
P & S Flt Dir Amps
Wx Radar
Rad devn comparator
2 Rad switch unit A
Radio switch unit C

Phase C

Attitude Comparator
Stbd Att Amp
Stbd Compass amp
Stbd Master Com unit
P & S Flt Dir amp
Interface modulator
Mach trim
2 DME
Wx Radar
Rad Devn Comparator

DC SUPPLIES. Fig.2 shows the 28V DC supply circuits and distribution.

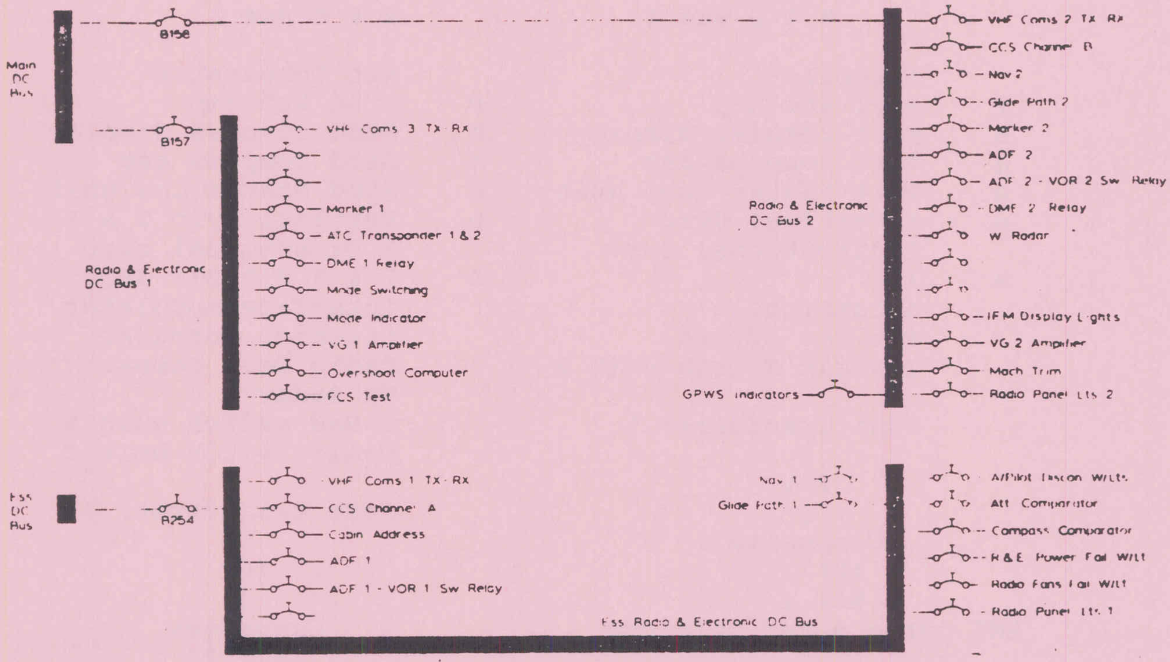
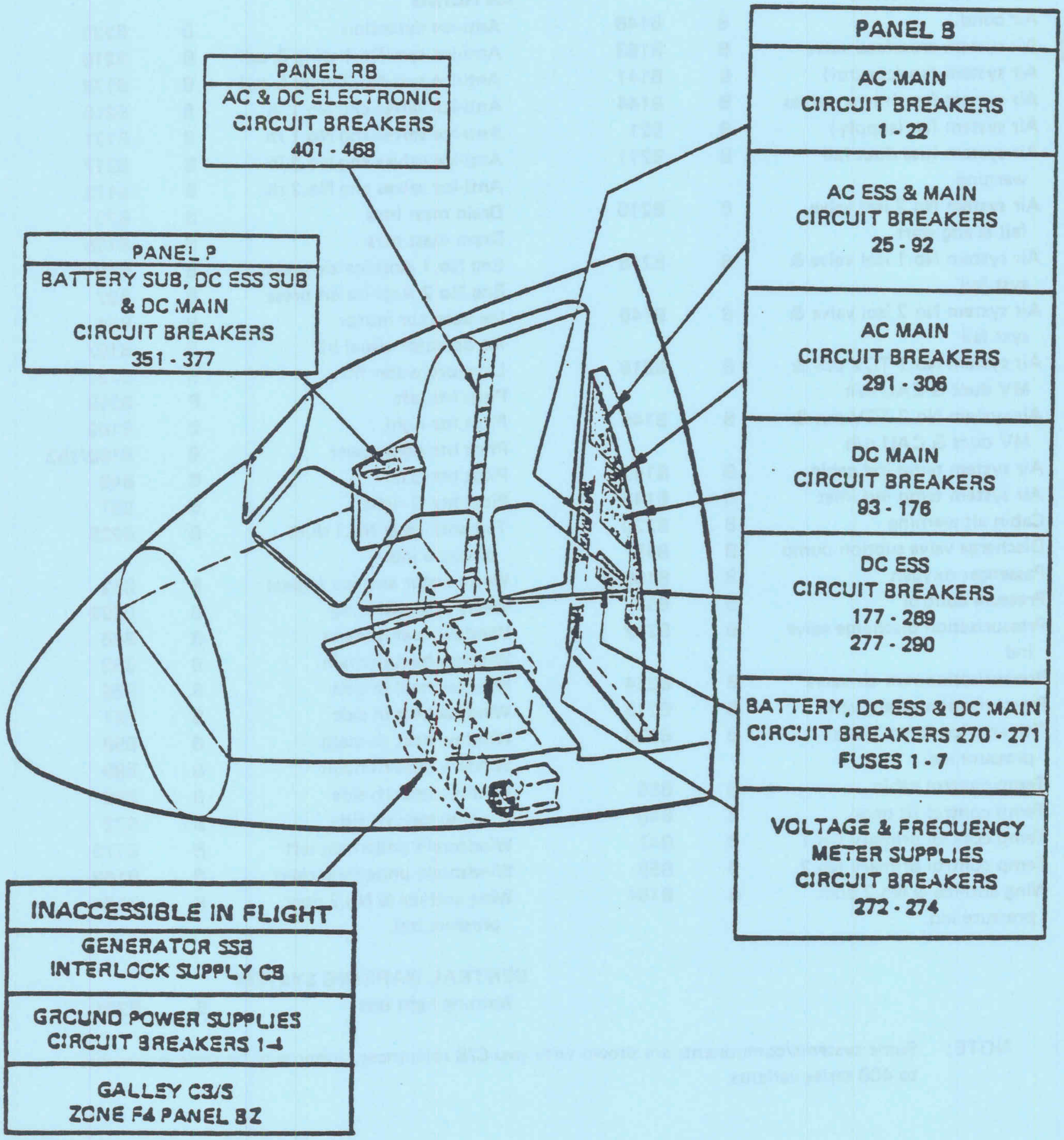


FIGURE 2 - RADIO DC DISTRIBUTION

RADIO COOLING FANS SWITCH. Marked 'No.1 - No.2', on the roof panel, this switch controls the supply to the fan motors. The fans draw cooling air through the flight dock and electronics bay racks. There is no off position so the selected fan will run whenever the Main AC busbars are energised.

FAN FAIL WARNING LAMP. Amber, on the roof panel. Provided the R & E DC bus is energised, the lamp comes on when neither cooling fan is running. Connected to the amber MWS.

ELECTRICAL DISTRIBUTION 400
FUSE AND CIRCUIT BREAKER CHART


PANEL RB
AC & DC ELECTRONIC CIRCUIT BREAKERS 401 - 468
PANEL P
BATTERY SUB, DC ESS SUB & DC MAIN CIRCUIT BREAKERS 351 - 377
PANEL B
AC MAIN CIRCUIT BREAKERS 1 - 22
AC ESS & MAIN CIRCUIT BREAKERS 25 - 92
AC MAIN CIRCUIT BREAKERS 291 - 306
DC MAIN CIRCUIT BREAKERS 93 - 176
DC ESS CIRCUIT BREAKERS 177 - 269 277 - 290
BATTERY, DC ESS & DC MAIN CIRCUIT BREAKERS 270 - 271 FUSES 1 - 7
VOLTAGE & FREQUENCY METER SUPPLIES CIRCUIT BREAKERS 272 - 274
INACCESSIBLE IN FLIGHT
GENERATOR SSB INTERLOCK SUPPLY CB
GROUND POWER SUPPLIES CIRCUIT BREAKERS 1-4
GALLEY C3/S ZONE F4 PANEL 8Z

	PANEL	CB-FUSE
AIR CONDITIONING		
Air cond.	B	B148
Air system crossfeed valve	B	B163
Air system fan (control)	B	B141
Air system fan shutter valves	B	B144
Air system fan (supply)	B	B21
Air system fuse duct fail warning	B	B211
Air system No.2 isol valve fail & eng start	B	B210
Air system No.1 isol valve & syst fail	B	B218
Air system No.2 isol valve & syst fail	B	B145
Air system No.1 TCV pos & MV duct & CAU o/h	B	B219
Air system No.2 TCV pos & MV duct & CAU o/h	B	B146
Air system temp ind cabin	B	B142
Air system temp ind inlet	B	B143
Cabin alt warning	B	B220
Discharge valve suction pump	B	B46
Passenger oxygen	B	B135
Pressure control	B	B53
Pressurisation discharge valve ind	B	B212
Pressurisation ram air valve	B	B214
Pressurisation safety valve	B	B213
Tail anti-ice & No.1 duct pressure ind.	B	B225
Temp control cabin	B	B56
Temp control flt deck	B	B48
Temp control primary No.1	B	B47
Temp control primary No.2	B	B55
Wing anti-ice & No.2 duct pressure ind.	B	B164

	PANEL	CB-FUSE
ANTICING		
Anti-ice detection	B	B226
Anti-ice syst No.1 wing & tail	B	B215
Anti-ice syst No.2 wing & tail	B	B173
Anti-ice valves eng No.1 lh	B	B216
Anti-ice valves eng No.1 rh	B	B171
Anti-ice valves eng No.2 lh	B	B217
Anti-ice valves eng No.2 rh	B	B172
Drain mast htrs	B	B70
Drain mast htrs	B	B155
Eng No.1 Anti-ice air press	B	B79
Eng No.2 Anti-ice air press	B	B87
Ice detector motor	B	B64
Ice detector visual htr	B	B107
Lavatory water htr.	B	B73
Pitot htr left	P	B369
Pitot htr right	B	B109
Pitot htr right lower	B	B150/153
Pitot htr Q left	B	B49
Pitot htr Q right	B	B57
Tail anti-ice & No.1 duct pressure ind.	B	B225
Waste water anti-ice (pipes)	B	B52
Waste syst anti-icing	B	B292
Window heat lh main	B	B66
Window heat lh main	B	B82
Window heat lh side	B	B65
Window heat lh side	B	B51
Window heat rh main	B	B59
Window heat rh main	B	B89
Window heat rh side	B	B58
Window heat rh side	B	B72
Windshield underheat left	B	B170
Windshield underheat right	B	B169
Wing anti-ice & No.2 duct pressure ind.	B	B164
CENTRAL WARNING SYSTEM		
Warning light test	B	B201

NOTE: Some systems/components are shown with two C/B references, either may be appropriate due to 400 series variants.

	PANEL	CB-FUSE
DOMESTIC SERVICES		
Evacuation alarm (401)	B	B500
Evacuation alarm (408 408A 416)	B	B290
Galley load shed	B	B88
Galley relay	Zn F4	1028-1030
Galley supply No.1	B	B19
Galley supply No.2	B	B20 B22
Galley supply No.3	B	B1
Lav exhaust fan	B	B81
Lav water heaters	B	B73
Shaver outlets (401)	B	B74
Water level ind	B	B156
DOOR WARNING SYSTEM		
Airstep warning forward	B	B108
Door warning lights	B	B168
Door warning lights	B	B176
ELECTRICAL POWER		
*APU (grnd/control)	ZnF4	B4
Battery ind.	B	B246
Battery sub-bus supply	B	B270
CSD disconnect No.1	P	B362
CSD disconnect No.2	P	B363
CSD failure warning No.1	B	B189
CSD failure warning No.2	B	B190
Ess bus fail (DC)	B	B162
Ess bus supply	B	B77
Ess radio	B	B29
Ess radio	B	B254
Ess sub-bus supply	B	B249
Ess supply volts and freq.	B	B43
Gen APU fail (W/lt)	B	B264
Gen APU volts & freq.	B	B273
Gen control APU	B	B262
Gen control panel No.1	B	B251
Gen control panel No.2	B	B252
Gen No.1 fail (w/lt)	B	B255
Gen No.2 fail (w/lt)	B	B256
Gen No.1 o/heat No.2 cooling	B	B257
Gen No.2 o/heat No.1 cooling	B	B258
Gen No.1 volts & freq.	B	B272
Gen No.2 volts & freq.	B	B274

*Inaccessible in flight.

	PANEL	CB-FUSE
Main bus-bar failure (AC)	B	B248
Main bus-bar failure (DC)	B	B247
Main ess-bus link	B	F4
Main sub-bus supply	B	B161
Split (AC)	P	B361
Split (DC)	P	B353
*SSB interlock	J	B1
Standby inverter (AC)	B	B253
*TRU grnd/pwr (input)	ZnF4	B1
*TRU grnd/pwr (output)	ZnF4	B2
TRU No.1 (input)	B	B17
TRU No.2 (input)	B	B18
TRU No.1 (output)	B	F3
TRU No.2 (output)	B	F5
Undervolt detector No.1	B	B13
Undervolt detector No.2	B	B14
Voltmeter (battery)	P	B358
Voltmeter (main)	B	B149
ENGINES		
Eng. control & cross feed valve ind APU	B	B263
Fire detector APU	P	B376
Fire detector APU	B	B40
Fire extinguishers APU	P	B356
Firebell	P	B371
Fire bottle ind	B	B200
Fire detector Zone 1 Eng 1	B	B36
Fire detector Zone 1 Eng 2	B	B38
Fire detector Zone 2 Eng 1	B	B37
Fire detector Zone 2 Eng 2	B	B39
Fire and o/heat by pass Eng. No.1	B	B236
Fire and o/heat by pass Eng No.2	B	B239
Fire and o/heat Zone 1 Eng. No.1	B	B234
Fire and o/heat Zone 2 Eng. No.1	B	B235.

NOTE: Some systems/components are shown with two C/B references, either may be appropriate due to 400 Series variants.

	PANEL	CB-FUSE
ENGINES (Cont'd.)		
Fire and o/heat Zone 1 Eng. No.2	B	B237
Fire and o/heat Zone 2 Eng. No.2	B	B238
Fire extinguishers Eng. No.1	P	B354
Fire extinguishers Eng. No.2	P	B355
High ignitor Eng. No.1	P	B364
High ignitor Eng. No.2	P	B365
Low ignitor Eng. No.1	B	B60
Low ignitor Eng. No.2	B	B54
Oil press ind No.1	B	B44
Oil press ind No.2	B	B45
Oil press LP No.1	B	B221
Oil press LP No.2	B	B222
Oil temp ind No.1	B	B223
Oil temp ind No.2	B	B224
Start and control APU	B	F1
Start master	B	B250
Thrust reversers unlock No.1	B	B187
Thrust reversers unlock No.2	B	B188
Vibration ind No.1	B	B34
Vibration ind No.2	B	B35
FLIGHT CONTROL SYSTEMS (FCS)		
Auto-pilot	RB	B443
Auto-pilot Monitor	RB	B461
Auto-pilot warning	RB	B406
Comp dir ind No.1	RB	B446
Comp dir ind No.2	RB	B459
Comp No.1	RB	B436
Comp No.2	RB	B456
Gyro vertical No.1	RB	B437
Gyro vertical No.2	RB	B457
HDI altitude No.1	RB	B438
HDI altitude No.2	RB	B458
HDI No.1 mode	RB	B417
HDI No.2 mode	RB	B424
HDI selector RL 1	RB	B434
HDI selector RL 2	RB	B407
Horizon monitor	RB	B415

	PANEL	CB-FUSE
Mach trim	RB	B430
Mach trim	RB	B464
Navigation c/o	RB	B408
Steer comp No.1	RB	B447
Steer comp No.2	RB	B445 B455
FLYING CONTROLS		
Elevator trim tab pos ind	B	B25
Flap position ind (left)	B	B42
Flap position ind (right)	B	B303/B86
Flying controls hyd fail & ind No.1	B	B227
Flying controls hyd rail & ind No.2	B	B228
Flying controls No.1 hyd fail	B	B159
Flying controls No.2 hyd fail	B	B160
High speed warning No.1	B	B277/116
High speed warning No.2	B	B278/117
Lift dump ind	B	B231
Standby elevator control	B	B186
Tail trim posn ind	B	B30
FUEL		
APU fuel valve	P	B375
Booster pump left fwd	B	B5
Booster pump left aft	B	B6
Booster pump centre left	B	B7
Booster pump centre right	B	B8
Booster pump right aft	B	B9
Booster pump right fwd	B	B10
Contents left	B	B31
Contents centre	B	B32
Contents right	B	B33
Flowmeter No.1	B	B93
Flowmeter No.2	B	B95
Low pressure left	B	B94
Low pressure right	B	B96
Low pressure No.1 system	B	B204
Low pressure No.2 system	B	B205
Low pressure transfer	B	B206
Refuel control	B	B207

NOTE: Some systems/components are shown with two C/B references, either may be appropriate due to 400 Series variants.

FUEL (Cont'd.)

	PANEL	CB-FUSE
Temp indicator	B	B101
Top temp & dip control No.1	B	B63
Top temp & dip control No.1	B	B99
Top temp & dip control No.2	B	B71
Top temp & dip control No.2	B	B100
Transfer valves left	B	B97
Transfer valves right	B	B98
Valve crossfeed	P	B367
Valve low pressure left	P	B366
Valve low pressure right	P	B368

HYDRAULICS

	PANEL	CB-FUSE
Acc brake press brakes	B	B27
Acc brake press systems	B	B28
Aux hyd pump OFF-LOAD	P	B374
Brake press. left and right	B	B90
Flap lower solenoid	B	B192
Fluid contents	B	B191
Offload solenoid No.1 and feel	B	B105
Offload solenoid No.2	B	B106
Pump No.1 AC	B	B4
Pump No.2 AC	B	B3
Pump No.1 O/H	B	B102
Pump No.2 O/H	B	B103
Pump standby	B	B271
Standby elevator control	B	B186
Standby steering LP warn	B	B232
Standby steering valve	B	B104
System No.1 isol valve	B	B194
System No.2 isol valve	B	B197
System No.1 L/P warn	B	B196
System No.2 L/P warn	B	B199
System No.1 O/H	B	B195
System No.2 O/H	B	B198

FLIGHT

	PANEL	CB-FUSE
Altimeter servo left	RB	B441
Altimeter servo right	B	B306
Flight recorder	RB	B453
Outside air temp	B	B83
Standby horizon	B	B26

LIGHTS

EXTERNAL

	PANEL	CB-FUSE
Flt inspection (wing) left	B	B126
Flt inspection (wing) right	B	B127
Landing lights left control	B	B293
Landing lights left filament	B	B294
Landing lights nose	B	B167
Landing lights right control	B	B295
Landing lights right fitment	B	B296
Nav lights	P	B372
Rotating beacons lower light	B	B134
Rotating beacons lower motor	B	B298
Rotating beacons upper light	B	B129
Rotating beacons upper motor	B	B297
Service (Freight Bay)	B	B122
Turn off left	B	B124
Turn off right	B	B125

FLIGHT DECK

	PANEL	CB-FUSE
A.S.I. light	B	B266/261
Chart lights capt's	B	B132
Chart lights F/o and ped lights	B	B133
Cockpit fluorescent lights	B	B291
Compass and console lights	P	B373
Door warning lights	B	B168
Door warning lights	B	B176
Instr. integ'l lights Capt's panel	B	B92
Instr. integ'l lights Centre panel	B	B62

NOTE: Some systems/components are shown with two C/B references, either may be appropriate due to 400 Series variants.

FLIGHT DECK (Cont'd.)

	PANEL	CB-FUSE
Instr. integ'l lights F/o	B	B61
Instr panel floodlights	B	B261/260
Panel lights	RB	B413
Panel lights	RB	B433
Roof lights	B	B131
Roof panel lights	B	B259/266
Roof panel lights	P	B357
Roof panel floodlights	B	B260/267

PASSENGER SERVICES

	PANEL	CB-FUSE
Cabin roof left	B	B80
Cabin roof right	B	B91
Emergency light system 1	B	B202
Entrance and set	B	B121
Reading lights left aft	B	B140
Reading lights left fwd	B	B138
Reading lights right aft	B	B139
Reading lights right fwd	B	B137
Warning signs	B	B136

RADIO SUPPLIES

	PANEL	CB-FUSE
Essential radio	B	B29
Essential radio	B	B254
Instr transformer No.1	RB	B439
Instr transformer No.2	RB	B460
Radio DC supply No.1	B	B157
Radio DC supply No.2	B	B158
Radio power No.1	B	B15
Radio power No.2	B	B16
ADF No.1	RB	B420
ADF No.2	RB	B425
Altitude alerting	B	B151
ATC transponder No.1	RB	B449
ATC transponder No.1	RB	B421
ATC transponder No.2	RB	B463
ATC transponder No.2	RB	B435
Capt's audio	RB	B409
DME No.1	RB	B416
DME No.1	RB	B452
DME No.2	RB	B427
DME No.2	RB	B466
F/o audio	RB	B410
Glideslope No.1	RB	B403
Glideslope No.2	RB	B426
GPWS AC	RB	B451
GPWS DC	RB	B411
HF No.1 communications	RB	B419
HF No.1 communications	RB	B444
Marker	RB	B428
Music reproducer control	RB	B429
PA Amplifier	RB	B405
Rack cooling fan No.1 bus	RB	B450
Rack cooling fan No.2 bus	RB	B462
Rack cool light	RB	B418
Radar AC	RB	B454
Radar DC	RB	B423
Radio altimeter	RB	B412
Service inter amp	RB	B404
VHF No.1 communications	RB	B401
VHF No.2 communications	RB	B431
VHF No.1 navigation	RB	B402
VHF No.2 navigation	RB	B432
Voice recorder	B	B50/B154
Voice recorder	B	B74/B154

STALL PROTECTION

	PANEL	CB-FUSE
Auto-ign & stall warn No.1 vane heat	B	B76
Auto-ign & stall warn No.2 vane heat	B	B84
Stall ident No.1 system control & ind	B	B177
Stall ident No.1 system control & ind	B	B178
Stall ident No.2 system control & ind	B	B165
Stall ident No.2 system control & ind	B	B166
Stall ident system fail ind	B	B152
Stall ident No.1 vane heat	B	B67
Stall ident No.2 vane heat	B	B75
Stall protection No.1 system	P	B370
Stall protection No.2 system	P	B351

UNDERCARRIAGE

	PANEL	CB-FUSE
Anti-skid inboard	B	B240
Anti-skid outboard	B	B241
Anti-skid test	B	B85
Landing gear indication	B	B203
Landing gear lever lock	B	B115
Landing gear relays left	B	B242
Landing gear relays left	B	B243
Landing gear relays right	B	B244
Landing gear relays right	B	B245
Landing gear warning	P	B377

NOTE: Some systems/components are shown with two C/B references, either may be appropriate due to 400 Series variants.

AC DISTRIBUTION 400

	1 Main AC Bus	2Main AC Bus
Fuel;	booster pumps port tank fwd, starboard tank aft. Centre tank port transfer pump. Flowmeters. 1 Top temp & dip ctrl.	booster pumps port tank aft, stbd tank fwd. Centre tank stbd transfer pump. 2 Top temp & dip ctrl
Hydraulics;	Aux pump 2	Aux pump 1. Foot brake press gauges. Anti-skid test
Anticing;	side & main windscreens port. 1 eng air press gauge. Ice detector motor. Waste water pipes. Water system. 1 Stall recovery vane. 1 Stall warning & auto ign vane. Q Pitot port	side & main windscreens starboard 2 eng air press gauge Drain outlet Toilet water system 2 Stall rec vanes 2 Stall wrg & auto ign vanes Q Pilot stbd
Electrical;	Essential AC Bus normal TRU 1. U/volt detector 1	Galley load shed relay TRU 2. U/volt detector 2.
Air System;	Ground Conditioning Fan Pressurisation control Toilet fan. Flight deck temp control. 1 Primary TCV. Discharge valve suction pump.	Cabin temp control 2 Primary Temp Control.
Other;	Galley 1 . OAT gauge. Engine 1 low igniter.	Galley 2. CVR. Stbd altimeter. Standby horizon. Engine 2 low igniter. Yaw damper. Flt recorder. Stall protection.
Lighting;	Flight deck flourescent Cabin roof port. Toilets. Instrument integral stbd & central panels. Landing lamp control & filament port	Anti-col beacon motors cabin roof starboard instrument integral port panel Landing lamp control and filament starboard
FCS & Radio supplies;	See FCS & Radio	See FCS & Radio

Essential AC Bus

Fuel;	contents gauges
Engines;	Numbers 1 & 2 TVI, and 1 & 2 oil press gauges (transformers). Overheat control.
Hydraulics;	hyd press gauge, brake acc press gauge, Hand brake press gauge (transformer)
Fire detect;	Engine fire detect & zones 1 & 2 overheat. APU fire detect
Instruments;	Port altimeter. Standby horizon
Flt controls;	Flap position indicators (transformers) Elevator trim tab indicator (transformer Tail trim position indicator
Radio supplies	(See FCS & Radio section)

DC DISTRIBUTION

MAIN DC BUS BAR

Fuel;	Flowmeters 1 & 2. LP w/lts eng & booster. Fuel Temp gauge. Top temp & dip ctrl. Fuel transfer valves.
Anticing;	pitot heaters stbd. System 2 wing & tail valves. Eng 1 & 2 stbd valves. System 2 duct pressure gauge. Windscreen u'heat w/lts. Overheat control & w/lts. Visual ice detector heater. Drain mast heater. Crossfeed valve control. Wing temp indicator.
Air Cond;	Fan (ground) control. 2 TCV position ind. 2MV duct & CAU w/lts. Main temp ind. Cabin temp ind. System 2 isolation valve & system fail w/lt. Heat exchanger outlet shutter. Crossfeed valve control.
Electrical;	Main DC sub bus bar. DC fail w/light. Test sockets.
Hydraulics;	Standby steering valve solenoid. Aux pump motor overheat w/lts. Off load solenoid.
Lights;	Nose landing. Turn-off. Anti-collision. Entrance & step. Red & White floods. Flight Deck chart P1 & 2. Service. Passenger reading & notices. Door warning. Ice inspection port & stbd.

Flying Ctrls;	Stall rec controls & indicators No 2 system. Spoiler fail MI's.
Others;	High speed warning 1 & 2. Cockpit Voice Recorder. Domestic water level w/lt & chlorine test. Stbd altimeter vibrator. Landing gear lever lock system. Passenger oxygen.

MAIN DC SUB BUS

Stall prot system 2. DC u/volt detector amplifier

ESSENTIAL DC BUS BAR

Fuel;	LP warning lights 1 & 2 system. Refuel Control. Transfer LP w/light.
Engines;	Thrust reverser unlocked lights. Oil temp gauges. Oil LP w/lts. Start relays. Fire & Overheat zone 1 & 2 w/lts. Fire bottle discharge indicators. Engine 1 & 2 high igniters.
Anticing;	System 1 wing & tail valves. Engine 1 & 2 port valves. System 1 duct pressure gauge. Ice detector. Air crossfeed indicator. Tail antice temp indicator.
Electrical;	Elect Ess sub bus bar. W/Lts test. Generator fail w/lts. Standby inverter. Bus fail w/lts. Battery MI. Main DC bus isolation relay coil
Air Cond;	fuse duct fail w/lt. 1 & 2 Isol valves & system fail w/lts. 1 TCV posn & MV inds. 1 MV Duct & CAU overheat w/lt. Discharge valve indicator. Safety valve. Ram air valve. Cabin alt w/lt. Air crossfeed indicator.
Flying Ctrls;	Servo fail w/lts. Servo power MI's. Lift dump control & MI's. Emergency elevator control. Stall Rec system 1 controls and indicators. Flap lower solenoid.
Hydraulics;	Fluid contents gauge. Isolation valves. Fluid overheat lights. Pressure LP w/lts. Landing Gear position lights and relays. Standby steering w/lt. Anti-skid system.

Lights; Instrument panel flood. Steward call. Red and white floods. Roof panel. 1 & 2 Emergency systems. Floor proximity lighting transmitters.

APU; Fuel pump. Generator fail w/lt. Generator control.

Others; Port altimeter vibrator. Altitude alert system. Landing gear lever lock system.

ESSENTIAL DC SUB BUS BAR

Fuel LP cocks. Fuel Crossfeed cock MI. Engine Fire bottles 1st shot. Both engines high igniters. CSD disconnect. Compass, console & nav lights. APU fuel valve. APU Fire detector. Fire bell. Stall protection system 1. Pitot heater port. Configuration & Gear warning. Standby Horizon.

Battery Bus Bar	Battery Sub Bus Bar
Battery sub bus bar	Eng fire bottles 2nd shot
APU start & ctrl	APU fire bottle
Hyd DC pump	Flight deck roof light

FCS & RADIO POWER SUPPLIES & COOLING

GENERAL. The FCS and all radio systems power supplies are automatically fed, via the cb's on panel B, from the aircraft bus bars to the Radio and Electronic Bus Bars, of which there are three DC and three AC. There are no master switches controlling the supplies to these. Supplies to the individual systems or units, are taken from the R & E Bus Bars via the cb's on Panel RB.

AC SUPPLIES. Fig. 1 shows the AC supply circuits;

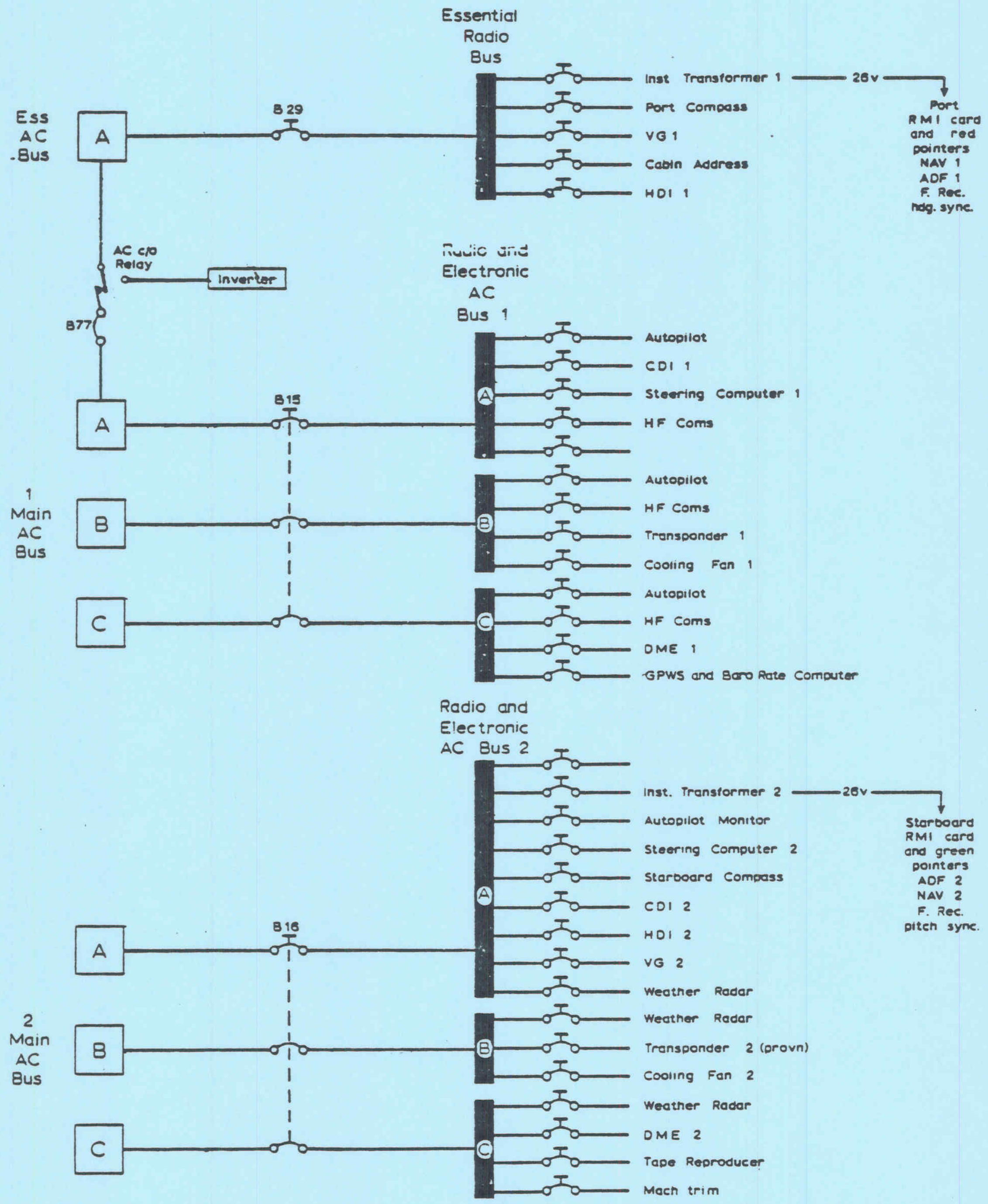
The Radio and Electronic AC Bus Bars 1 & 2 are normally fed from 1 and 2 Main AC Bus Bars respectively. In the event of a generator failure, causing the SSB to close, the R & E bus bars are both fed from the remaining serviceable aircraft bus bar.

The R & E Essential AC bus bar is fed from the aircraft essential AC bus bar.

cont/...

Two instrument transformers, providing 26V AC for certain instrument functions, take their power supplies seperately form No 2 R & E AC bus and the Essential R & E AC bus.

FIGURE 1 - RADIO AC DISTRIBUTION



DC SUPPLIES. Fig.2 shows the 28V DC supply circuits and distribution.

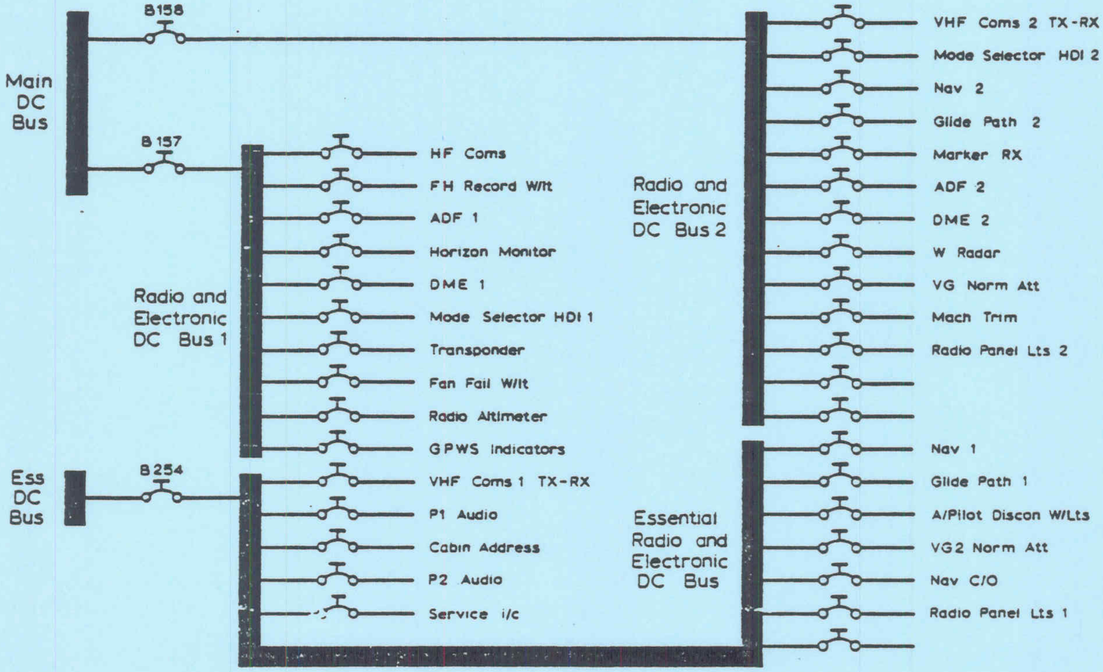


FIGURE 2 - RADIO DC DISTIRBUTION

RADIO COOLING FANS SWITCH. Marked 'No.1-OFF-No.2', on the centre console, this switch controls the supply to the fan motors. The fans draw cooling air through the flight dock and electronics bay racks.

FAN FAIL WARNING LAMP. Amber, on the centre console. Provided the Essential R & E DC Bus is energised, the lamp comes on when the Radio Cooling Fans switch is off, or in the event of motor failure or serious underspeeding of the selected fan. In the latter case, the alternative fan should be selected, which will put the light off.

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FLIGHT CONTROLLER

GENERAL The Flight Controller allows selection and operation of Flight Director and Autopilot functions excluding radio inputs. It contains servo-mechanisms and circuits for deriving Autopilot and Autothrottle manometric and pitch attitude lock error signals, and relays to provide the interlocks and to control the switching of signals. The various controls function as follows:-

A/P ENGAGE SWITCH. Sprung to the centre off position, the switch is held by solenoid at 'A/P Engage', the solenoid supply being controlled by the interlocks. At 'A/P Engage', power is supplied to the pitch, roll and rudder channel engage relays and servo motor clutches, and also to the pitch trim servo motor clutches.

At the moment of Autopilot engagement any locks (except Throt) on, go off so that the system is engaged in Unmonitored Heading Mode and the aircraft is held at the existing pitch attitude. If there is any bank angle, wings are levelled.

The Autopilot cannot be engaged unless:-

Vertical Gyros 1 & 2 are erected (2 mins from switch-on) -

All engage interlocks are made and -

6 secs have elapsed since auto-disconnect.

NOTE: In flight, 15 secs should elapse after auto-disconnect to allow flight disturbances to decay before re-engaging.

PITCH CONTROL. This rotates freely to allow a +/-17° adjustment of the Autopilot pitch attitude hold datum when the Autopilot is engaged in any mode except IAS or Height lock, during the finalstage of an acquire or coupled to a glide path. In the three modes mentioned, and when the Autopilot is disengaged, the control rotates without effect. On disengagement of the Autopilot, adjustments made with the control during engagement are automatically zeroed. Maximum rate of pitch control is 1.5° of elevator/sec.

AIRSPEED LOCK CONTROLS;
(SELECT SPEED COUNTERS)
(SPEED SELECTOR)
(IAS/THROT SWITCH)
(ENGAGE SWITCH)

The speed counters present the IAS, sensed by the Air Data Computer, only whilst IAS or Throt locks are not engaged. When a lock is engaged, the datum speed is theIAS at that instant; the speed selector then becomes effective, allowing the counters to be set to the datum speed required. Turned clockwise to increase speed, detent positions can be felt at 1 knot intervals. Departures from this speed, in IAS lock, then produce pitch demands, limited to +/-4°, until the difference is zero; in Throt lock it is zeroed by (auto) throttle adjustment. Regardless of the rate at which the Speed selector is turned, the maximum rate of pitch change is 1.5° of elevator/sec.

The IAS/Throt switch is sprung to 'Throt' and solenoid held at 'IAS'. The 'Engage' switch is sprung to off and solenoid held at 'Engage'. Both switches' hold-on solenoid supply is controlled by interlocks which prevent incompatible modes being engaged at the same time, or prevent the mode engagement without supporting systems.

IAS lock cannot be engaged without previous engagement of the Autopilot nor when a glide path is coupled. It will automatically change to 'Throt' lock, which remains engaged, when Height Lock is selected, or at the beginning of the flare on to an 'Acquire' height.

Throt lock may be engaged independently of the Autopilot and is incompatible only with IAS lock. The shared IAS/Throt selector switch prevents the incompatibility from arising. If the speed counters readout is not within +/-4 kts of the actual ADC IAS, Throt lock cannot be engaged. After engagement, tolerances allow the IAS to be up to 6 kts more than the selected speed.

AZ MASTER ON/OFF SWITCH. With the switch 'On', radio displacement and/or heading error signals may be passed to the Autopilot And, with the F/Dir switch 'On', the Flight Director. The heading error signals arise from the displacement between the Drift Index and the Track Pointer Head, Tail or Steering Index, depending on the Radio Coupling Switch position, of the selected compass. With the Drift Index placed under the

cont/...

compass fixed lubber as it will normally be, the lubber may be regarded as the heading error signal datum.

The Azimuth Master switch goes off on engagement of the Autopilot in order to disengage the Flight Director and thus to ensure that Flight Director and Autopilot coincide and to ensure also that the latter cannot be engaged with a large demand present. It may then be put 'On' again. With the switch off there is no azimuth control of the Autopilot or Flight Director.

Maximum bank angle demand is 28° + 15% except when coupled to a glide path, below 1200 ft, with Prime Land or Glide Gearing selected, when it becomes 15° + 15%.

HEIGHT ACQ/LOCK SWITCH
ENGAGE SWITCH
SELECT PRESSURE COUNTER & CONTROL
SELECT HEIGHT COUNTER & CONTROL.

These allow locking to an existing height; or climb or descent and automatic locking to, any pre-selected height controlled by either IAS lock or Throttle lock. The term height is used to mean height, altitude or flight level throughout.

The 'Select Pressure' control is rotated to set the digits as required, from 850 to 1050 mb; this will not vary the Select Height reading. Height above datum may be set as required by rotating the Select height control provided:-

Height 'Lock' is not engaged -

Flare to Acquire Height has not started -

'GP MAN' is not selected -

A glide path is not yet coupled on 'GP AUTO'

The Acq/Lock switch is sprung to 'Lock' and held at 'Acq' by solenoid. The 'Engage' switch is sprung to 'Off' and held at 'Engage' by solenoid. To lock to an existing height, the 'Acq/Lock' switch is left at 'Lock' and the Engage switch is put on, where it will stay provided a glide path is not coupled. IAS lock, if engaged will change to 'Throt' which will remain engaged. The Autopilot will then maintain the height at the moment of

cont/...

engagement. This datum cannot be varied whilst engaged.

To acquire a pre-selected height 'Acq' and 'Engage' are selected. The climb or descent to the pre-set height may then be initiated manually by throttle and/or pitch attitude adjustment, depending on whether 'IAS' or 'Throt' lock is engaged. Then, at a height error determined by the vertical speed, the flare on to the selected height begins. At this time, the IAS lock if engaged, reverts to 'Throt' and the 'Pitch' and 'Select Height' controls are de-clutched. On reaching the required height the 'Acq' position 'Hold on' is relaxed and the switch reverts to 'Lock'.

Assuming the datum set on the Select Presure counter is the same as that set on the altimete, the aircraft will maintain the selected height to within +/-300ft at 30,000 ft, down to +/-100ft at sea level. To ensure capture, the required height will normally be overshot by up to 45 ft per 1000 ft/min of vertical speed.

FLIGHT DIRECTOR MASTER SWITCH. Marked 'F/Dir' Sprung to off, held 'On' by solenoid. At 'On' the switch connects Flight Director demand signals to the Pitch and Bank Directors on the Attitude Directors. Pitch demands are presented on the Pitch Director only when coupled to a glide path or when using the F/Dir Pitch control. An interlock puts the F/Dir switch off when the Az Master is off.

GP AUTO/MAN SWITCH. This allows auto or manual coupling to a glide path. Sprung to centre off, it is held on by solenoid at 'Auto' and 'Man'.

Auto will hold on provided an ILS localiser frequency has been selected, the relevant Nav system is selected into the FCS and the Mode Indicator shows 'Beam'. If the aircraft is away from the glide path centre line nothing happens except that the Autopilot is armed ready for coupling. On reaching 1/10 dot deviation from the centre line, the glide path is coupled and elevator control signals are then derived from GP + Vertical Gyro + Pitch Rate. At capture, the glide-path may be overshot to the extent of 1 .3 dots up. If the glide path is captured from level flight

cont/...

with Height Lock engaged, the Height Engage switch goes 'Off' and a 2° pitch down demand is injected to assist capture. If the glide path is captured when descending under manometric or attitude pitch control these are disengaged, 'Pitch' control is de-clutched, and the IAS/Throt switch goes to 'Throt'.

Man would be selected on reaching the glide path as shown by the Glide Path Pointer. If Height lock is on, it will disengage and a 2° pitch down command is injected to assist capture.

PRIME LAND/GLIDE GEARING SWITCH. Sprung to centre off, this is held at 'Prime Land' or 'Glide Gearing' by solenoid and primes the FCS for (Prime Land) or (Glide Gearing) approach. The different functions of the Glide Gearing and Prime Land switch positions are shown in Approach Events, page 6A-15.

AUTOPILOT SWITCH. Marked On/Kill, this controls the 3 phase 115v AC and 28v DC power supplies.

AUTOTHROTTLE SWITCH. Marked On/Kill, this controls the single phase 115v AC supply.

COMPASS PORT-STBD SWITCH. This selects the Compass from which heading and radio information is fed to the Autopilot and Flight Director.

AUTO-FLARE TEST BUTTON
AUTO-FLARE MI Mounted on the throttle quadrant, pressing the button checks the flare phase monitoring. If this is serviceable the MI goes from blank to cross-hatch. The MI returns to blank when the button is released.

AUTOPILOT

GENERAL. The Elliott 2200 Monitored Single Channel Autopilot incorporates three sub-systems which drive the rudder, elevators and ailerons. Cor-ordination in azimuth is provided by integration of rudder and aileron control. The basic stabilising drive from the three sub-systems originates in sensor signals from which are computed demand signals. These are amplified to drive servomotors which in turn move the appropriate control run. Additionally, demand signals arising from coupling to heading, manometric or radio facilities may be injected.

The primary Autopilot sensors are:-

Three Axis Rate Transmitter

Vertical Gyros 1 & 2

Dynamic Vertical Sensor

Air Data Computer

Heading signals are taken from the selected Flight Compass and radio signals from the Radio Nav Systems.

The Autopilot is controlled at the Flight Controller and either of the Flight Compasses which allow operation in the following modes:-

Unmonitored Heading (Az Master off, no azimuth datum control)

Variable Heading (Az Master On)

IAS Lock

Height Acquire

Height Lock

VOR Coupled

Localiser Coupled

Glide Path Coupled

THREE AXIS RATE TRANSMITTER. Mounted at Panel RE, the Radar & Gyro tray. This incorporates three gyros which measure rate of rotation in pitch, roll and

cont/...

yaw. Proportional signals are generated, amplified and used by the control servomotors to damp out flight path disturbance.

VERTICAL GYROS (3) Panel RE. These are employed as shown in the Attitude & Flight Director System, VG1 providing the main vertical reference for the Autopilot. As well as pitch and roll signals, it also provides the versine signal which counters height loss in turns. As VG2 supplies the signals for the pitch and roll monitoring, failure of this or VG1 will cause loss of the Autopilot.

DYNAMIC VERTICAL SENSOR. Panel RE. This is a pendulum operated drive which detects sustained slip or skid and originates rudder control signals to correct it.

AIR DATA COMPUTER. Panel RD electronics bay. This converts pitot and static pressure into signals which are used to:-

Modify Autopilot response according to height and airspeed -

Provide airspeed control in IAS (by pitch attitude) and Throt modes -

Provide height control in Height Lock and Height Acquire modes, by pitch attitude control.

AUTOPILOT TRIM INDICATORS. For rudder, ailerons and elevators, these are mounted together, on the centre instrument panel. They shown the direction and magnitude of any command signals being applied to the servomotors with the Autopilot disengaged or, the out-of-trim state of the aircraft with the Autopilot engaged. Before Autopilot engagement the Trim Indicators should be 'floating' about the 'in-trim' position.

AUTOPILOT CUT-OUT BUTTONS (2). A Cut-Out button is mounted on each control column hand-grip. The Autopilot may also be cut out by applying a load on the control column in either direction, sufficient to cause the monitor to disconnect, or by selecting 'Kill' at the 'A/Pilot' switch.

A/PILOT ENGAGED MI (2). One on each main instrument panel, these are the dolls-eye type showing ENG or OFF as appropriate.

LAND ANNUNCIATORS (2) Mounted one on each main instrument panel, this is a four position dolls eye type magnetic indicator showing Blank, GLD, ARM or ATT phases of autoapproach as shown in Approach Events.

AUTOPILOT AUTO-DISENGAGEMENT WARNINGS. Visual and audio warnings of Autopilot auto-disconnect are provided.

Visual. A red lamp on each main instrument panel, energised from the Essential DC Bus, flashes if the Autopilot disconnects for any reason other than use of Cut-Out button or selection of 'Kill' at the 'A/Pilot' switch. Pressing either Cut-Out button then puts out both lights.

If the lamps' normal 28V DC supply fails, a standby supply from the Autopilot junction box is connected so that the lamps are then on steady when the Autopilot is engaged, and go out when it is disengaged regardless of reason.

Audio A two tone gong sounds in the headsets if the Autopilot disconnects for any reaon other than use of Cut-Out button or selecion of 'Kill' at the 'A/Pilot' switch. This may be cancelled by pressing either Cut-Out button whereupon the two tone changes to a steady note for two seconds and then stops. A brief note sounds in the headsets on using either Cut-Out button to disengage the Autopilot.

AUTOPILOT MONITORS

PITCH

ELEVATOR HARDOVER MONITOR. This in operation whenever the Autopilot is engaged and disconnects the Autopilot in the event of a failure which might otherwise cause the elevators to be operated fully in one direction. The monitor compares the elevator servo position and rate with a synthetic elevator demand signal. If there is a difference equal to 2° of elevator displacement, autodisconnect takes place.

ELEVATOR SERVO CLUTCH MONITOR. Operating whenever the Autopilot is engaged, this protects the aircraft from failure of the elevator servomotor or clutch by auto disconnect if a

cont/...

variation of more than +/-50% in the servomotor clutch current is detected.

TAILPLANE TRIM MONITOR. By bringing on the Auto Trim warning light this warns of disturbance which might result on autodisconnect with the tailplane out of trim.

AUTO TRIM WARNING LIGHT (1) amber on centre instrument panel. With a glide path coupled and Glide Gearing or Prime Land set, the lamp comes on if a sustained torque equal to 3.5° of elevator is applied for more than 20 seconds. The lamp remains on for 20 seconds after the auto trim has reduced the torque to less than 3.5°.

PITCH DEMAND & GP COMPARISON & PERFORMANCE MONITOR. This monitors GP performance and the computation of pitch demands airsing from GP deviation.

The comparison monitor is operative when below 1200 ft (QFE) with Glide Gearing or Prime Land set. This converts a pitch demand signal back to a GP deviation signal and compares it with a GP deviation signal that has been fed direct to the monitor. A fault condition equivalent to a difference between these two signals of a quarter dot of GP deviation, opens the interlock line which in turn causes autodisconnect.

The performance monitor is operative with Prime Land set from 400ft R down to 100 ft R and opens the interlock line at about one dot of GP deviation.

AUTOPILOT MONITORS

AZIMUTH

AILERON & RUDDER HARDOVER MONITORS. These disconnect the Autopilot in the event of a failure which might otherwise cause their associated control surfaces to be operated fully in one direction.

The Aileron Monitor compares the aileron servo position and rate with a synthetic aileron demand signal. If a difference equivalent to 3° or more of aileron position is detected, the interlock line is opened thus disconnecting the Autopilot.

The Rudder Monitor compares the rudder servo position and rate with a synthetic rudder demand signal. If a difference equivalent to 4° or more of rudder position is detected, the interlock line is opened thus disconnecting the Autopilot.

AILERON & RUDDER CLUTCH MONITORS. These protect the aircraft from failures of the aileron and rudder servomotors or clutches by autodisconnect if a variation of more than +/-50% in the servomotor clutch current is detected.

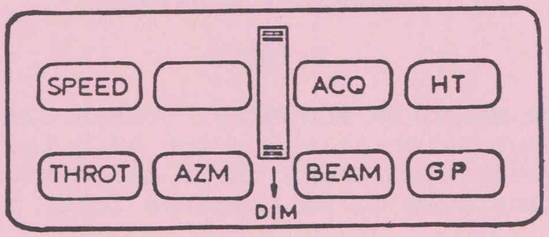
BANK DEMAND MONITOR. This compares the bank demand signal with a synthetic signal derived from beam error and bank attitude signals. A bank demand error of 6° or more causes a disconnect via the interlocks.

LOCALISER COMPARATOR & PERFORMANCE MONITOR. This ensures that the localiser beam error signal is relaible and that the localiser performance is acceptable.

The Autopilot will disconnect if deviation from the localiser becomes 1 dot or more, gradually reducing with height to 1/3 of a dot at 200ft radio alt.

Autodisconnect will follow also as soon as deviation reaches 1/3 dot on malfunction of the localiser signal.

MODE INDICATOR



Mounted one on each of the main instrument panels and, except for azimuth operating in parallel, the apertures are lit to show as follows.

SPEED - IAS lock engaged
ACQ - Height acquire selected (note 1)

cont/...

HT - Height lock engaged
THROT - Throttle lock engaged (note 2)
AZM - Azimuth master on and F/Dir on or A/P engaged (note 3)
BEAM - LOC or VOR coupled (note 4)
GP - Glide path coupled (note 5)

Note 1; ACQ flashes whenever the autopilot is engaged unless the height lock is engaged or height acquire is engaged or a glide path is coupled.

Note 2; THROT flashes on autothrottle failure

Note 3; AZM normally shows only on the side selected on the compass switch. However it will flash on both sides if, with Prime Land or Glide Gearing selected, a deviation develops of more than 1/3 of a dot from the localiser.

Note 4; BEAM flashes if, with Prime Land or Glide Gearing selected, the localiser signal becomes unsatisfactory.

Note 5; GP flashes if, with Prime Land or Glide Gearing selected, the glide path signal becomes unsatisfactory, or a deviation develops of more than 1 dot from the glide path, or the glide path deviation pointers differ by more than 1/4 of a dot. Except in manual flight with the flight director engaged GP will cease to flash at 100R

INTERLOCK FAILURE MONITOR

GENERAL. The A/P Engage switch hold-on solenoid is energised via an interlock line having a number of interlock contacts connected in series. Any one of these being open will prevent engagement or cause disengagement of the Autopilot.

The Interlock Failure Monitor continuously monitors the interlock line and indicates which of the contacts has opened. The system employs an IFM Display unit and the Interlock Failure Monitor unit.

IFM DISPLAY UNIT. Mounted on shelf 2 of the flight deck radio rack, a hole in the covering panel allows the face of the unit to be seen from the Captains seat.

The display features 36 red lamps numbered 1 to 36, each of which may be associated with an interlock, and which is lit when that interlock is the original cause of an auto-disconnect or failure to engage. The interlocks associated with the numbers are as follows.

1. Pitch comptr failure
2. Disconnect button
3.
4. DC power or Att monitor
5. Roll att monitor below 20ft Radio
6.
7. Vertical Gyros
8. Pitch A/P engage
9.
10.
11. Pitot-Static monitor
12. Ail. & rudder clutch monitor
13. Bank demand monitor
14.
15. Aileron hardover monitor
16. Rudder hardover monitor
17.
18.
19. LOC monitor
20. A/Throt or Rad Alt monitor
21. Ht switch monitor
22.
23. Flare logic monitor
24. Pitch att comparator
25.
27. GP monitor
28. Elev. clutch monitor
29. Radio Alt monitor below 100 ft R or prime land monitor
30.
31. Pitch monitor
32. Elev. hardover monitor
33.
34.
35. Pitch monitor
36.

Only one lamp should be lit at any time and this must be put out, to allow the system to operate again, by use of either the switch on the Display Unit or the button on the pedestal. However, a fault in the Unit may cause unallocated lamps to light.

IFM RESET/TEST SWITCH Mounted on the front of the Display Unit, reset is pressed momentarily to put out a light on the IFM panel and to re-cycle the logic if the reason for it being on is no longer present or the disconnect has been noted. The 'Test' side is for maintenance purposes only.

IFM RESET BUTTON. Mounted on the aft edge of the pedestal, the button has the same function as the reset position of the test/reset switch on the IFM panel

INTERLOCK FAILURE MONITOR UNIT. This is carried on shelf 6 of the electronic bay rack. A sensor circuit detects that the A/P Engage switch hold-on coil circuit is open. A scannner circuit then 'looks' at each interlock, establishes which one is open and causes the relevant lamp on the IFM Display to be lit. Other interlocks opening as a result of the first do not bring on their associated lamps.

APPROACH EVENTS

GP ENGAGE	GP sigs fed into Pitch demand -
	Fixed GP gearing -
	Fixed Pitch, Att & Rate terms increased -
	Nose-down datum signals fed into demand chain if GP captured with Height lock on -
	Red MWS for A/Throt disconnect -
	Pitch demand rate limit increased to 3° of elevator per sec.
PRIME LAND/ GLD GEARING SELECTED	Land Annunciator GLD -
	GP Comparator Monitor active -
	Auto-Trim w/lt active -
	Bank demand limit reduced to 15o-
	LOC integral bank law introduced -
	Pitch demand rate limit increased to 11° of elevator per sec -
	Autopilot autodisconnect if controlling NAV receiver power off -
	Mode Ind AZM flashes for 0.25 dot devn. from LOC.-
	BEAM flashes if LOC signal becomes unsatisfactory or fails -
	GP flashes if GP signal becomes unsatisfactory or fails or - If GP devn. pointers disagree by more than 0.25 dot or - If there is more than 1 dot devn. from the glide path.

Height	Glide Gearing Selected	Prime Land Selected
1200ft AAL (Switch selection)		Airspeed error term included in GP control law. Elevator demand limited. Radio Altimeter or Pitot - Static Monitor failure will cause Autopilot autodisconnect.
400ft R		Land Annunciator ARM - All monitors active - Autodisconnect and Land Annunciator goes blank if any approach monitor in fail condition -
200ft R	GP gearing halved	GP gearing halved
100ft R	Land Annunciator GLD Attitude hold GP perf. monitor off Mode Ind. GP steady	Land Annunciator ATT Attitude hold GP perf monitor off Mode Ind. GP steady
90ft R	Autodisconnect if Attitude Hold not achieved	
50ft R	Manual Disconnect required	Land Annunciator Blank Throttles start to close Flare commences A/P & A/Throt interlocked disengagement of one takes out the other. Airspeed error 6kts limit removed for nose-up elevator demands
20ft R		Bank angle comparator introduced to cause disconnect if bank exceeds 4.5°, +/- .5°
Touchdown		Manual disconnect required

AUTOTHROTTLE SYSTEM

GENERAL. The Autothrottle System provides the 'Throt' speed lock and autoflare power control by controlling both throttle levers. Engagement is possible at any speed up to 350 kts IAS. Below 165 kts IAS full power is available. At 165 kts IAS and above, limit switches prevent the throttles from opening beyond approximately the recommended climb power setting.

Monitoring circuits protect the aircraft from faults which might cause hardover demands or control, by disengaging the system with appropriate warning.

All the system controls, except the Cut-Out Buttons, are featured in the Flight Controller. In addition to units mentioned elsewhere the system employs:-

A Computer/Amplifier -
One Actuator -
Two Cut-Out Buttons

COMPUTER/AMPLIFIER. Mounted on shelf 5, electronics bay, this is a twin channel unit having circuits for error signal processing, amplification and auto-monitoring. The error signal arises from the difference between the actual airspeed and the speed set with the 'Select Speed' control. This signal is processed into a demand signal which is fed to the Actuator. A duplicate demand signal is produced in the monitor channel.

At 50 ft radio height, on an Autoland approach flare is initiated and the demand signal derived from the error signal is replaced with one which will close the throttles at 5°/sec.

Comparator circuits operate to put of the Speed 'Engage' switch and flash the Mode Indicator if Air Data Computer power fails, or when the difference between the demand and monitor signals exceed 4kts and the deviation occurs at a rate exceeding 1kt per second. If the rate of deviation is less than 1kt per second, a disconnect may not occur. A clutch monitoring circuit produces the same result if the Actuator clutch current varies by +/-50%.

cont/...

The Mode Indicator flashes also when putting the 'Engage' switch off with 'Throt' engaged. After glide path capture, a red MWS warning is also given in these events. The flashing is cancelled by pressing the Autothrottle Cut-Out Buttons.

Below 50' Radio on an Autoland approach the Autopilot and Autothrottle are interlocked, disengagement of one will cause the other to disengage.

ACTUATOR. This employs the demand signal from the Computer/Amplifier to drive a servomotor. This shaft rotation is taken through a gearbox to two electro-magnetic clutches through which the torque is transmitted to the throttle levers.

CUT-OUT BUTTONS (2). Mounted one on each throttle lever, pressure on either one, or both, disengages 'Throt' lock without any indication except for the disappearance of 'THROTT' on the Mode Indicator.

If the 'THROT' lock is disengaged by putting off the 'Engage' switch or selecting 'Kill' at the 'Auto Throttle' switch, the buttons will still have to be pressed to cancel the Mode Indicator and MWS flashing.

If the cut-out button is used below 50'Radio on an autoland approach the autopilot will also disconnect

COMPASS SYSTEM

GENERAL. The Compass System comprises two separate identical gyro-magnetic compass systems, one providing the port heading displa and the other the starboard. Either system may provide a heading monitoring signal for the Autopilot and heading information for other units, the choice being made at the 'Compass' switch on the Flight Controller. Either System may be used as a directional gyro.

Magnetic heading indication is accurate to within +/-1° provided the deviation and latitude compensation is correct. In the DG mode with correct latitude compensation, random drift does not exceed 3°/hour.

Automatic beam capture is provided and allows interception at any angle within 90° relative to the beam QDM or QDR. The angle prior to capture is determined by the Steering Index setting and is the angular difference between this and the Track Pointer Head setting. The final intercept angles are; LOC 40°, VOR 18°.

The complete system incorporates:- 2 Directional Gyros, 2 Detector Units, 2 Master Compass Units, 2 Flight Compass Amplifiers, 2 Flight Compasses.

DIRECTION GYRO. (2) These are hermetically sealed, low drift-rate electrically driven azimuth gyros providing a short term directional reference in the compass mode and a long term reference in the DG mode. In the Compass mode they are monitored by reference to the earth's magnetic field except during aircraft turns at more than 15°/min. The inhibition during turns avoids sensing the vertical component of the earth's field and prevents the erroneous heading signals which would otherwise result.

DETECTOR UNITS. (2), one mounted in each wing tip, sense the direction of the earth's magnetic field relative to the aircraft heading and produce two signals proportional respectively to the sine and cosine of the angle between the aircraft heading and the earth's magnetic meridian. The detector elements are pendulously mounted so they remain in the horizontal plane and are sensitive only to the horizontal component of the earth's magnetic

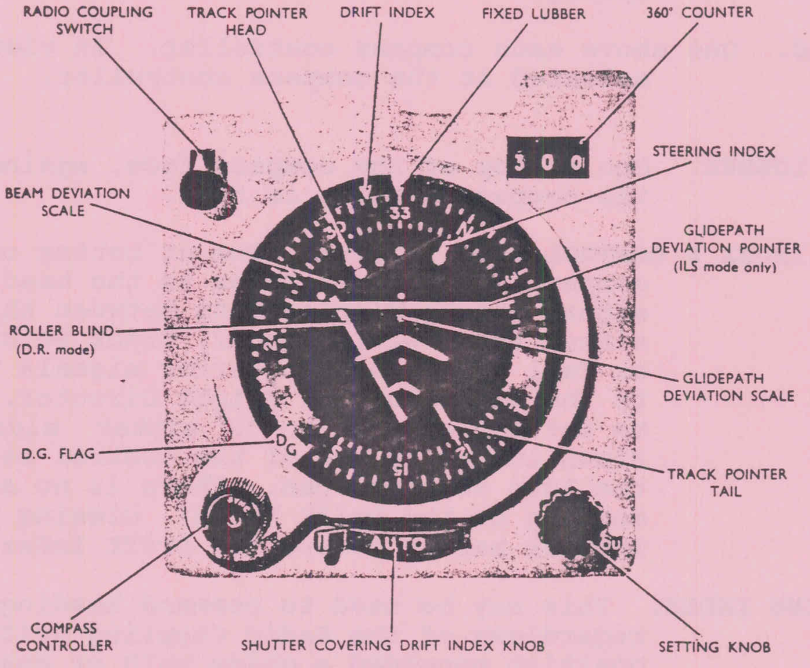
cont/...

field. The two signals produced are fed to a resolver synchro in the Master Compass Unit.

MASTER COMPASS UNIT. (2) These pass magnetic or DG heading information to the Flight Compasses and the heading monitoring signal to the Autopilot; four additional synchros pass the same heading information to other units. The unit compares heading information from the Directional Gyro with magnetic heading inormation from the Detector Unit and provides a signal to monitor the gyro.

The front panel carries the deviation corrector controls, the lattitude correction control, a monitoring current meter, a digital heading indicator and a turn reset indicator.

FLIGHT COMPASS DISPLAY AMPLIFIER. This incorporates the amplifier and other circuitry associated with the Flight Compass. It also provides the fixed supplies to the motors in the Flight Compass and the DC supplies for radio switching circuits.



FLIGHT COMPASS

FLIGHT COMPASSES (2). One on each main instrument panel. Provides each pilot with independant heading and course information, combined with radio navigation data derived from VOR or ILS

cont/...

Localiser and Glideslope sources. The controls and indicators are as follows.

COMPASS CONTROLLER. One on the bottom left corner of each Flight Compass. Selected to Comp for conventional gyro compass use, the monitoring rate is 3° +/- 0.3°/min and the compass card is self-synchronising.

Pressing the 'Sync' button with Comp selected gives fast card synchronising at 15° +/-3°/sec. Complete sysnchronisation is indicated by a small oscillation of the card whilst the button is pressed. The Sync button may be pressed in flight only when that compass is uncoupled from the autopilot and the aircraft is in level flight at unchanging speed.

Selected to DG for use as a directional gyro, the compass card can be set as required at 15° +/-3°/sec (F), or 2° +/0.2°/sec.(S) in a clockwise (+) or anti-clockwise (-) direction by moving the knob to either side, against a spring.

DG FLAG. One above each compass controller. In view when DG selected at the compass controller.

FIXED LUBBER. One at top of the compass face, against which the compass heading is read.

DRIFT INDEX & CONTROL AUTO SHUTTER. One at bottom of each compass. The Drift Index is the heading-error signal datum; displacement between this and either the Steering Index, Track Pointer Head or Tail causes heading-error signals to be fed to the Autopilot and Flight Director. It may be set manually up to 30° either side of the Fixed Lubber by use of the control seen with the Auto Shutter open. There is no automatic setting of the Drift Index; closing the Auto Shutter merely covers the Drift Index Control.

STEERING INDEX. This may be used to command headings regardless of the Radio Coupling Switch position provided a glide path or beam is not coupled. It may be set at any point on, and rotates with, the Compass Card. Displacement between it and the Drift Index, causes heading error signals to be fed to the Autopilot and Flight Director; a turn is then demanded until the Steering Index and Drift Index coincide.

cont/...

It becomes inoperative at the beginning of beam capture which on a Localiser is at 4° from the beam centre line and on a VOR, 3.7°.

TRACK POINTER HEAD. This rotates with the Compass Card and may be set at any point round it. It is used, when radio NAV inputs are employed, as an OBS to select a bearing or track with which is compared the radio bearing information being received. Displacement between the bearing selected and the bearing received then produces radio displacement signals which, when the Radio Coupling Switch is at Track Pointer Head, may be fed to the Autopilot and Flight Director.

In addition to demands arising from radio nav input, heading-error signals due to the displacement between the Track Pointer Head and the Drift Index also are fed to the Autopilot and Flight Director.

In the absence of radio nav inputs, the Track Pointer Head may be used to provide track steering in the same manner as the Steering Index, with manual Drift Index Setting.

TRACK POINTER TAIL. This pointer, as its name implies, remains always 180° removed from the Track Pointer Head. Again, heading error signals arising from the displacement between the Track Pointer Tail and Drift Index may be fed to the Autopilot and Flight Director when it is required to fly the reciprocal of the track selected at the Track Pointer Head.

360° COUNTER. This repeats the selection made with the Track Pointer Head. The QDM of a VOR beacon may be seen on the 360o Counter by rotating the Track Pointer Head until the VOR TO indication is aligned with it.

SETTING KNOB. This is pulled out and roated to set the Steering Index, pushed in and rotated to set the Track Pointer Head. In the latter case, the Beam Deviation Scale, Track Pointer Tail and Roller Blind rotates together with the Track Pointer Head.

RADIO COUPLING SWITCH. This switch selects for use either the Steering Index, Track Pointer Head or Track Pointer Tail. Regardless of whether radio nav inputs are present or not, Track Pointer Head

cont/...

must be selected to employ that pointer. Radio nav coupling is precluded when Steering Index is selected.

Track Pointer Tail is selected to fly the reciprocal of the track selected at the Track Pointer Head. The Track Pointer Tail then functions as described, and additionally, reverse radio nav coupling then takes place to preserve correct left-right sense.

ROLLER BLIND. The four backgrounds, DR mode, ILS, VOR to and VOR from, against which the aircraft symbol on the cover glass is seen, and which are seen in relation to the Beam Deviation Scale and Track Pointer Head, are carried on a Roller Blind. This moves laterally over its rollers to bring into view the relevant presentation as demanded by the selection of an ILS or VOR frequency and by the setting of the Track Pointer Head.

On VOR with a setting within +/-90^o of the QDM, the VOR 'TO' presentation is in view; this comprises a very acute 'V' bar presentation, offset to either side of the aircraft symbol engraved on the cover glass by the displacement, if any, of the aircraft from the selected radial. The amount of displacement is shown on the Beam Deviation Scale. The point of the 'V' indicates the position of the radio facility and a setting greater than +/-90^o presents the 'FROM' mode, in which the point of the 'V' is behind the aircraft instead of ahead of it in the 'TO' mode

In ILS mode the roller blind presents the Localiser as the centreline division of blue and yellow segments, indicating right and left of the localiser respectively.

The DR mode is presented when the FCS Radio Input switch is selected OFF. The Roller Blind should not then move from side to side.

During aircraft turns, the Roller Blind rotates with the Compass Card, Track Pointer Head and Tail, Beam Deviation Scale and Steering Index; when the Track Pointer Head is being set, it rotates with that. In both cases it may also move laterally whilst rotating.

BEAM DEVIATION SCALE. Against which the Roller Blind representation is seen, this is carried on the same movement as the Track Pointer Head and is fixed in relation to it. In the ILS mode each dot represents 1.25° deviation; in the VOR mode 5o.

GLIDE PATH DEVIATION SCALE AND POINTER. The Glide Scale is engraved on the cover glass and fixed. The Glide Path Pointer appears when the glidepath signal is received. Movement of the Glide Path Pointer over the Glide Path Scale shows the demand arising from deviation from the glidepath. The relative position of the aircraft symbol and the Glide Path Pointer shows the direction of the demand.

COMPASS COMPARATOR WARNING LIGHT. (1) Amber, on the port instrument panel. Provided neither compass is selected to 'DG' and the aircraft is not turning at more than 15°/min, their heading indications are continuously compared. If a disagreement of 5o or more exists for more than 45 seconds, the warning light comes on and an amber MWS warning is given. The 45 seconds delay allows for transient discrepancies which may arise during sustained turns or yaw disturbance.

COMPASS TRANSFER SOCKETS. Panel RA. Transposing the plugs at this point allows the RMI cards, and 1 & 2 NAV Systems to take their heading signals from the Port Compass in the event of failure of the Stbd. Compass. Heading for the Flight Recorder would then be lost.

ATTITUDE SYSTEM.

GENERAL The Attitude System provides pitch and roll attitude displays for both pilots, and attitude information for other systems. It employs:-

3 Vertical Gyros (VG) -
1 Attitude Comparator -
2 Attitude Director Display Amplifiers -
2 Attitude Directors.

VERTICAL GYRO 1 (VG1) provides pitch and roll information for the attitude display on the port Attitude Director and also for the Autopilot.

VERTICAL GYRO 2 (VG2) provides pitch and roll information for the attitude display on the starboard Attitude Director and also for the autopilot Pitch & Azimuth Monitors.

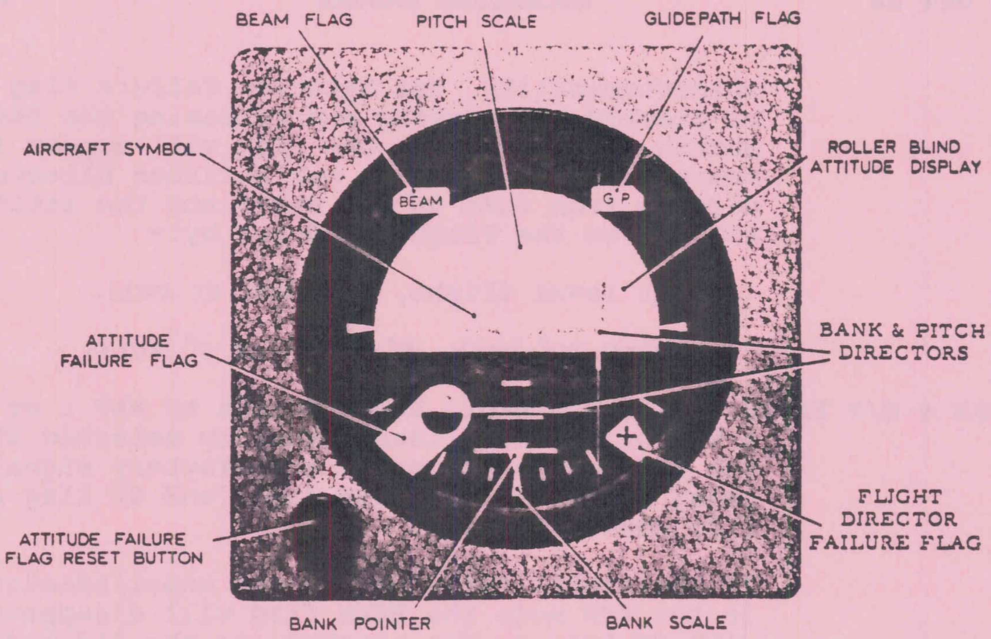
VERTICAL GYRO 3 (VG3) provides pitch and roll information for the Attitude Comparator, Flight Director and Weather Radar, and pitch only for the Flight Recorder.

FLT SYSTEM GYROS SWITCH. On panel P, this controls the single phase 115v AC supply to VG1, 2 & 3.

ATTITUDE COMPARATOR. This compares, each with the others, pitch and roll signals from VG3 and those repeated back from both Attitude Directors to detect the odd one out. If a fault is found in either instrument, its Attitude Failure Flag shows, if VG3 or the Attitude Comparator itself is faulty, both Flight Director Failure Flags will show, both Attitude Failure flags might show and attention will be drawn by the FD ATT warning lamp

FLIGHT DIRECTOR ATTITUDE (FD ATT) WARNING LAMP. (1) Amber, mounted on the port instrument panel, this comes on if VG3 or the Attitude Comparator fails. Failure of VG3 would fail the Flight Director; failure of the Flight Director for any other reason would not bring on the light. The lamp is connected to the amber MWS.

ATTITUDE DIRECTOR DISPLAY AMPLIFIER (2). Circuits in this and the Attitude Director form the servomechanism which operates, in response to signals from the VG, to control the roller blind attitude display in the Attitude Director. It also handles Flight Director signals from the Steering Computer via the Interface Unit.



ATTITUDE DIRECTOR

ATTITUDE DIRECTOR. The Attitude Director replaces the conventional artificial horizon and additionally presents Flight Director information by movement of the Flight Director Index over the display. The component parts are shown in the accompanying diagram and comprise;

ROLLER BLIND ATTITUDE DISPLAY. Attidude is presented on a roller blind which moves over its rollers across the face of the instrument to shows changes in pitch, and rotates to show changes in roll. The pitch scale, representing 10°, 20° and 30°, is carried on the roller blind and is seen against the aircraft symbol fixed on the inside of the outer glass and against the centre mark on the front of the inner glass.

In level flight the horizon appears as a white line separating the lower, dark grey, and upper, light grey, semi-circles.

BANK POINTER
BANK SCALE These provide conventional indication of bank angle. The bank angles shown are 10°, 20°, 30° and 60°.

ATTITUDE FAILURE FLAG RESET BUTTON. The Attitude Failure Flag

ATTITUDE FAILURE FLAG will remain in view after intial switching on. After two minutes, provided gyro erection is complete and there is no cont/...

unserviceability, the Attitude Failure Flag may be cleared by pressing and releasing the Reset Button. Thereafter, the flag will appear if the attitude display on one Attitude Director differs from that on the other and the attitude signals to the Flight Director by:-

In level flight, 5° pitch or roll.

With 30° bank, 5° pitch or 7° roll.

BEAM & G/P FLAGS. With FCS Radio Input switch to NAV 1 or 2, a VOR or ILS localiser frequency selected at the NAV Controller and a satisfactory signal being received, the BEAM flag (and GP flag on ILS) shows steadily.

If the signal fails or becomes unsatisfactory, in the VOR mode the BEAM flag will disappear; with GP Auto or Man slected, in the ILS mode the BEAM and/or GP flags will pulse.

FLIGHT DIRECTOR.

GENERAL The Flight Director provides a visual monitor of demands to the Autopilot, and presents demands to the pilot in manual flight, arising from all modes of operation except IAS, Height and Height Acquire locks. Control switches, Az Master and F/Dir, are covered in the desription of the Flight Controller. It employs, in addition to the units already mentioned, the two remaining movements in the Attitude Director and:-

F/Dir Pitch control -
Steering Computer -
Interface Unit.

FLIGHT DIRECTOR INDEX. The Pitch Director is a horizontal wire which moves vertically, the Bank Director is a vertical wire which moves horizontally; their intersection is referred to as the Flight Director Index. Demands arising from heading error, radio displacement or attitude, or a combination of any or all of these, are shown by movement of the Flight Director Index over the attitude display. The aircraft may then be flown so as to follow the Index and position the datum, the centre of the aircraft symbol, on it. This will place the aircraft into an attitude which will follow the demand

cont/...

signal. As the demanded heading or attitude is approached, the demand signal will diminish and if the Index and datum are kept coincident the manoeuvre will conclude with the aircraft at the new heading or attitude.

FLIGHT DIRECTOR FAILURE FLAG. The flag on both instruments will be in view with the Pitch & Bank Directors

Parked	Not Parked
If the F/Dir switch goes off due to ;	
1) The Az Master switch going off or	1) If the Beam or GP signals become unsatisfactory or fails or
2) VG 3 failure or	2) If the Compass Comparator warning light comes on or
3) Attitude Comparator failure or	3) If the port and stbd Flight Director demands differ.
4) Either Pitch Director hitting the stops	

F/DIR PITCH CONTROL. (1) Mounted on the pedestal, this allows manual positioning of the Pitch Director to present 0 to 15° of pitch up or 0 to 5° of pitch down demand, except when coupled to a glide path.

STEERING COMPUTER. Flight Deck rack. This takes attitude signals from VG3 and the F/Dir Pitch control, heading error signals from the selected Compass and radio deviation signals, singly or collecively, and processes them into demand signals. These signals are finally taken after further modification to the Pitch and Bank Directors.

The unit is self monitored and will also detect the lack of a signal required for the selected mode. Either fault will cause the Flight Director Failure Flags to show.

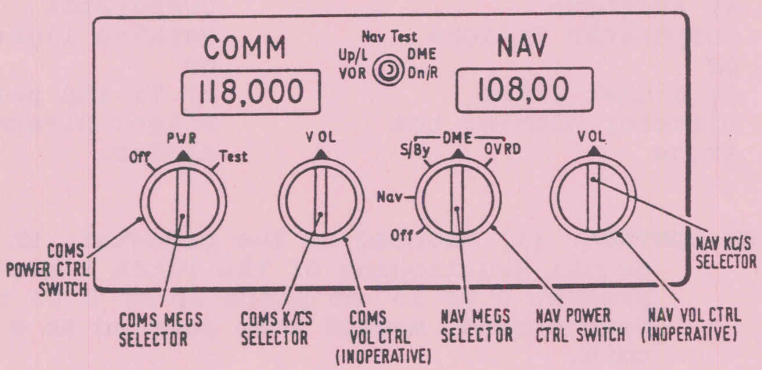
INTERFACE UNIT. Flight Director signals are processed in this unit to counter incompatability between systems. They are also taken to comparators in which demand signals, and position signals fed back from the Attitude Director Amplifiers, are monitored. Any difference between these or between the presentation on each Attitdue Director causes the Flight Director Failure Flags to show.

RADIO NAV SYSTEMS

GENERAL Independent, identical twin systems for the reception of VOR and ILS LOC & GP are provided by two complete Collins 51RV-2B installations. These are NAV 1 and NAV 2. Two Marconi AD 260 marker beacon systems, MKR1 and MKR2, complete the ILS requirement.

The systems incorporate:-

2 Controllers, 2 Marker Aerials,
2 FCS Radio Input switches,
2 Marker Receivers, 2 VOR/ILS Receivers,
1 VOR/LOC Aerial.



VHF COMM/NAV CONTROLLER

CONTROLLER Two combined VHF Com/Nav Controllers are mounted on the pedestal, NAV 1 port. The Nav side of each Controller allows selection of 200 channels, with 50 Kc/s spacing, within the band 108 - 177.95 Mc/s and a further 60 channels, with 50 Kc/s spacing, within the band 133 - 135.95. The latter band allows reception of unpaired (with VOR) DME stations. A shutter covers the megacycles digits whilst the megs selector is being rotated from 118 to 132.95. Selection of a LOC frequency on Nav 1 or 2 automatically selects the paired GP frequency. Selection of a VOR frequency on Nav 1 or 2 automatically selects also the paired DME. Further contacts on the frequency select switches determine the display, VOR or ILS, on the Flight Compass.

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NAV POWER CTRL SWITCH. Marked Off, Nav, Stby, DME, Ovrd.

Off - All power off.

Nav - Nav system power on. This remains on in all positions except 'Off'.

Stby - See DME

DME - "

Ovrd - "

NAV TEST SWITCH. This allows self-testing of VOR, ILS and DME circuits and has 3 positions; centre off, left and right as follows:-

UP/L - VOR. In this position, with a LOC frequency selected and the Nav system being checked selected at the associated FCS Radio Input switch, the associated Flight Compass LOC presentation should move one dot to the left and the Glide Path Deviation Pointer one dot up within about 5 seconds of pressing the switch. If the 'Beam' and/or 'GP' flags are up at the time, these will clear when the switch is pressed and then re-appear. With a VOR frequency selected, the relevant RMI pointers should show QDM 180 and, with the Nav system being checked selected at the associated FCS Radio Input switch and the associated Compass Track Pointer Head set on 180, a VOR 'TO' presentation should be seen. If the BEAM flag is up at the time, it will clear and then re-appear.

DME - DN/R. Similar to above in regard to ILS except that the presentations move one dot right and down respectively. The DME function is covered in the DME description.

FCS RADIO INPUT SWITCHES. Two, mounted one on each port and starboard instrument panel and marked Off - Nav 1 - Nav 2, these control the input to the FCS. The port switch selects Nav 1 or 2 to the port Flight Compass, the starboard switch selects Nav 1 or 2 to the starboard Flight Compass. With the same Nav system selected on both switches, the Track Pointer Head of the selected (Port or Stbd) Compass is the controlling OBS and will vary the presentation on both Flight Compasses.

VOR/ILS RECEIVER. Two, mounted on shelf 3 of the flight deck radio rack. This unit incorporates four sub assemblies as follows:-

VHF Nav Receiver. This receives VOR and LOC signals within the band 108 - 117.95 Mc/s, and holds system self-testing circuits.

Glidepath Receiver. This receives glidepath signals within the band 329.3 - 335 Mc/2, processes them and provides glidepath deviation and GP flag outputs to the FCS.

VHF Synthesiser. This controls VHF Nav Receiver frequency and tuning.

VOR/LOC Instrumentation Unit. This takes VOR or LOC signals from the VHF Nav Receiver, and track selection and magnetic heading signals from the FCS. It produces VOR or LOC deviation signals, VOR TO/FROM signals and BEAM flag signals for the FCS. It also produces VOR relative bearing signals for the RMI pointer.

MARKER RECEIVER. Two, mounted on shelf 3 of the flight deck radio rack. This operates on a fixed frequency of 75 Mc/s and provides reception of ILS and airways fan markers. Output is presented aurally on selection of MKR1 or MKR2 at Station Boxes, and visually on three lamps labelled AIRWAYS (white), MIDDLE (amber), OUTER (blue), MKR1 port instrument panel, MKR2 starboard. A HI/LO switch for each system is mounted directly beneath the associated lamps. The LO position attenuates the receiver for ILS markers.

The systems are supplied whenever Radio 1 & 2 DC Bus Bars are energised; there are no power control switches.

NAV. PRESENTATION. The six instruments concerned with the display of information from NAV1 & NAV2 are:-

Two Flight Compasses
Two Attitude Directors
Twin RMI

The presentation on the Flight Compasses is covered in the Compass System, that on the Attitude Directors in the Attitude and Flight Director Systems. RMI's are featured in the ADF System.

AERIALS Both NAV systems share the VOR/LOC aerial either side of the fin and the glidepath aerial in the radome. Marker aerials are in the mid lower fuselage, MKR1 foremost.

POWER SUPPLIES. These are shown in Chapter 5 Power Supplies.

RADIO ALTIMETER SYSTEM

GENERAL The Bendix ALA.51A Radio Altimeter System provides an indication of aircraft height up to 2500 ft above the surface, indication of descent through a given height, and height outputs for the FCS. The latter are employed as switching signals, and as height signals to the flare computer for pitch attitude control during an autoland approach. The system also provides a height output for GPWS.

Accuracy is the greater of +/-2 ft or 2% of the indicated height within the range 0 to 500 ft., +/-5% within the rnge 500 to 2500 ft. In the event of a failure in the system, self-monitoring circuits operate to stop the pointers momentarily, open the Radio Altimeter interlock, show the fail flags then drive the pointers out of sight behind the masks off the scale. With 'Prime Land' selected, opening the Radio Altimeter interlock will cause an Autopilot auto-disconnect.

The system employs two Radio Altimeter indicators, a Radio Altimeter Tx-Rx unit and two aerials.

RADIO ALTIMETER INDICATORS. (2) mounted one in each port and starboard instrument panel. These are calibrated linearly to 480ft then logarithmically to 2500ft, and carry a pointer, a mask, two controls, a moveable index, an amber lamp and a red/white flag. Above 2500ft the pointer is concealed behind the mask and the flag is unseen.

PUSH TO TEST BUTTON. If the system is serviceable when the button on either instrument is pressed, the pointer goes to 30 ft. and the flag shows, as seen in Fig.1, on both instruments.

AMBER LAMP. The control sets the minimum decision altitude
MDA SET CONTROL index at any point round the dial. On

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descending through the set height, the dimmable amber lamp comes on and will remain on whilst the aircraft is below the set height. It will be seen that the index must be set below zero to put the lamp out on the ground.

RADIO ALTIMETER Tx-Rx UNIT. Mounted in the electronics bay, this incorporates the transmitting, receiving, processing and self-monitoring circuits of the system. A transmission of continuously varying frequency, 4200 to 4400 Mc/s, is directed towards the surface and reflected back to the receiver. The distance the wave has travelled (twice the aircraft height) is calculated from the difference between the frequency being transmitted and that being received back at any instant.

AERIALS. These are both cone shaped, mounted with their open ends flush with the skin of the under fuselage, 20 inches apart, transmitter aerial foremost.

POWER SUPPLY. This is shown in Power Supplies & Cooling. There is no power control switch; the system is energised whenever Radio 1 AC Bus is supplied and is immediately operative.

ADF SYSTEMS

GENERAL Two AD360 installations form independent, identical twin systems each providing:

Reception of CW (A0 or A1); MCW (A2); R/T (A3). Continuous Automatic Direction Finding. Aural manual DF without sensing. Frequency coverage is 100 to 1799.5 kc/s in 0.5kc steps with an unusable band between 450 and 460 kc/s.

The main units are 2 controllers, 2 receivers, 2 loop aerials and 2 sense aerials

CONTROLLER. (2) mounted on the pedestal. This carries all the controls for the system, is integrally illuminated and incorporates:-

TUNING SWITCHES. The three larger rotary switches select, from the left, hundreds, tens and 0.5 units of Kc/s, seen in the aperture. The entire range from 100 to 1799.5 Kc/s may be selected, including the unusable 10 Kc/s from 450-460 Kc/s.

FUNCTION SWITCH. Marked Off-ADF-Ant-Loop.
Off. All power off.
ADF. Automatic direction finding.

Ant. Operating as normal receiver, using sense aerial.
Loop. Operating as normal receiver using loop aerial, plus manual aural direction finding.

LOOP CONTROL SWITCH. Operated in conjunction with the Loop and ADF positions of the Function Switch, this actually controls the rotation of the goniometer search coil. Spring loaded to off in the centre, the direction and speed of rotation of the search coil varies with the direction and amount of Loop switch movement.

SHARP/BROAD SWITCH. varies receiver selectivity. Band passed on Sharp 1.2 Kc/s, Broad 3 Kc/s.

GAIN CONTROL. Self evident. Alignment of the white dots gives minimum volume.

BFO SWITCH. Selected to BFO (beat frequency oscillator) to read CW (A0 or A1) signals, OFF for MCW (A2) and R/T (A3).

BFO CONTROL. Varies the pitch of the CW note heard. Alignment of the white dots gives the mean frequency.

RECEIVER. Two, on shelf 5, electronics bay. The receiver is crystal controlled, completely transistorised and automatically tunes, in two seconds, to the frequency selected at the controller. The frequency is accurate to within +/-50 c/s provided that whenever the power is interrupted, the frequency in use is re-selected. Frequencies outside the stated coverage must not be used for ADF.

LOOP AERIAL. Two, on upper fuselage centre line, ADF1 foremost. This is non-rotating and formed of two flattened loops fixed at right angles to each other and mounted, on the longitudinal axis, with their planes vertical to the horizontal plane of the aircraft.

A fixed quadrantal error correction of +14.5° is built in by using more turns in the fore and aft loop than the athwartships one. Additional QE correction is provided by a QE and loop equaliser unit.

SENSE AERIAL. Two, mounted in the wing root fairings, ADF1 port. This is a suppressed type, and is employed as a simple aerial when Ant is selected at the Function Switch. In ADF it is used in resolving the 180o ambiguity of the loop to provide bearing sense. A sense equaliser unit adjacent to the receiver matches the aerial to the receiver.

BEARING PRESENTATION. Relative bearings from each ADF system are presented on two Radio Magnetic Indicators on which they may be seen as relative or magnetic.

RADIO MAGNETIC INDICATORS (2) One on each main instrument panel. The RMI may show, simultaneously, the aircraft heading and relative and magnetic bearings from:-

Both NAV systems (VOR) or -
Both ADF systems or -
Either one of the ADF and NAV systems.

The instrument carries two concentric 360° scales, a compass lubber mark and two pointers. The outer, fixed scale, against which relative bearings are read, is simply calibration pips at 45° intervals. The inner, rotating scale with a perimeter of 5° calibrations, is a compass repeater.

Residual deviation affecting the FCS compass is small enough to be disregarded for this purpose, so we may say that magnetic heading may be read off the inner scale against the lubber mark. The pointers have fed to them bearing information which is always relative to the heading of the aircraft so they will be seen to be pointing, in azimuth, towards the station concerned.

Reference to a pointer against the outer scale will thus show a relative bearing; reference to the same pointer against the inner, or compass, scale will provide the QDM. To make the VOR presentation at the pointers relative, synchros in the NAV system subtract the aircraft magnetic heading from the QDM provided by VOR.

Normally, the drive for the RMI compass cards comes from the starboard compass so that failure of the port compass does not leave the port instrument panel without heading indication. If the starboard compass fails, RMI compass drive may be taken from the port compass by a plug transfer. The RMI compass card drive is amplified within the instrument.

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One of the RMI pointers is red, single barrelled and presents the bearing information from ADF1 or NAV.1. The other pointer is green, double-barrelled and presents the bearing information from ADF2 or NAV2 systems. Two switches control the inputs to the pointers.

RMI INPUT SWITCHES. Two ADF/VOR switches on the pedestal control the input to the RMI pointers. The left hand switch feeds ADF1 or VOR1 bearings to the red pointers of both RMI's, the other feeds ADF2 or VOR2 bearings to the green pointers of both RMI's. The switches also feature in input indicator circuits.

RMI INPUT INDICATORS. Two magnetic indicators adjacent to each RMI show ADF1 or VOR1 input to the red pointers of both RMI's and ADF2 or VOR2 input to the green pointers of both RMI's.

The circuit to the ADF side of these is complete when ADF is selected at the RMI Input switches and the associated ADF system Function Switch is at ADF.

The circuit to the VOR side is complete when VOR is selected at the RMI Input switches, the NAV controller is ON and a VOR frequency is selected.

POWER SUPPLIES. These are featured in Chapter 5 Power Supplies. It will be seen that ADF1 is fed from the Radio essential DC Bus and remains available until the aircraft battery is exhausted.

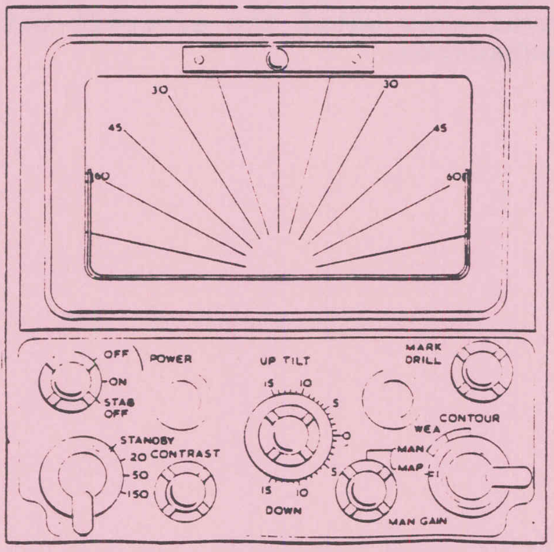
WEATHER RADAR SYSTEM

GENERAL. The EKCO 290 Weather Radar system provides continuous indication of cloud range and bearing, indicates most turbulent cloud, and may be used to determine cloud height or to 'paint' a map of the surface ahead of the aircraft.

Pulses of X band RF energy are radiated in a 3.7° pencil beam, or in an edgewise 75° fan-shaped beam, sweeping 90° either side of the aircraft nose. Some of this energy is reflected back and presented as information on a cathode ray tube screen. The scanner is stabilised in pitch and roll.

Reflections from denser clouds, such as Cumulonimbus (Cb) supporting large water droplets, give the brightest return. The range from which returns would be expected may be reduced in direct proportion to the density of intervening rain. Due to the penetration of clouds by some of the energy, returns may be seen from the full horizontal extent of a layer up to the maximum range of the system.

It should be noted that a cloud-enveloped mountain-top may give the same indication as a fully developed Cb cloud. The hail content of a Cb may appear as a pointed or a hooked finger, and the edge of the cloud scalloped. A rapidly changing cloud shape indicates a probability of turbulence and the possibility of hail



RADAR INDICATOR UNIT

INDICATOR UNITS (2). At forward ends of port and starboard consoles. Each incorporates a display screen and all the system controls as shown above. The screen has engraved bearing markers at 15° intervals. Range markers are electronically produced in accordance with the range selected and are linear in scale.

POWER SWITCH Three position rotary switch with positions;

'POWER OFF' All power is off.

'POWER ON' Power and stabiliser are operative within two minutes of switching 'On'

'STAB OFF' The gyroscope stabilisation is off, so the scanning plane will vary with the aircraft attitude.

RANGE SWITCH. Four position rotary switch. At the 'STANDBY' position, provided the power switch is On, the equipment is held in readiness at operating temperature, scanning becoming operative immediately a 'range' position is selected. The range positions of 20, 50, 150 nautical miles are self evident.

CONTRAST CONTROL. Adjusts display to suit flight deck lighting conditions.

TILT CONTROL. Allows up to 15° elevation or depression of beam.

MAN GAIN CONTROL. Manual receiver gain control in Man and Map positions of the Function Switch.

FUNCTION SWITCH. Four position rotary switch with settings;

CONTOUR. Returns above a pre-set level are inverted so that they produce less brilliance on the screen instead of more, regardless of range. Thus the active centres of Cb cloud appear as dark areas. The Manual (receiver) Gain control is inoperative. STC (Sensitivity Time Control) circuits are operative, so giving consistent displays for a given cloud up to a range of 25n.m. Beyond 25 n.m. clouds appear less severe with increase in range.

WEA. Clouds are presented as bright areas on the screen. Manual gain is inoperative. STC is operative.

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MAN. This selection is suitable for long range mapping. Manual receiver gain control operative, STC inoperative.

MAP. The beam is modified, so as to sweep on area of ground in front of the aircraft. The swept area is presented on the screen as a map revealing significant physical features. The size of the area displayed will depend on aircraft height, range in use and scanner tilt. Manual gain is operative. STC is inoperative.

MARKER BRILLIANCE CONTROL Varies brilliance of range markers.

MASTER INDICATOR LAMPS (2). One above the screen of each controller. A small neon lamp which lights when the appropriate Radar Control switch is pressed.

RADAR CONTROL SWITCHES (2). One below each indicator. When a switch is pressed its indicator takes over control of scanner function (Tilt, stab ON/OFF, and beam shape), and the master indicator lamp lights. If the 'master' indicator is switched off, control reverts automatically to the other indicator, if it is switched on.

TRANSMITTER/RECEIVER. Panel RC, electrical bay. This unit incorporates circuits which produce the various power supplies from the aircraft 115V AC and 28V DC, form the synchronising pulses and generate the radiated energy. It also contains the receiver local oscillator and mixer stages and one IF amplifier stage. The front of the unit carries two fuses.

SCANNER. Nose radome. This unit incorporates components for forming, propagating and receiving the beam, for scanning ahead, for stabilising the aerial in pitch and roll and for synchronising the Indicator display. The rotating parts are the 24 inch parabolic reflector and dipole aerial.

POWER SUPPLIES. These are shown in Chapter 5 Power Supplies. Due to the time taken by the Radio AC Supply Relays to change over, the system will go off for 2 minutes from the time 1 Main AC Bus is de-energised or re-energised.

ATC TRANSPONDER

GENERAL. The Cossor SSR2100 ATC Transponder system automatically responds to interrogation from the ground to provide Air Traffic Control authorities with aircraft identification, flight level and tracking information. It may also be used to acknowledge ATC messages in the event of failure of aircraft R/T transmitters and to indicate that an aircraft is in distress. Range of the system with standard ground equipment is about 180n.m. at 35,000 ft. Two Transponder Units and one Controller are carried.

CONTROLLER. On the pedestal, this carries controls as follows:-

FUNCTION SWITCH. Marked; Off - S/B - A-B.

Off - All power off.

S/B - Power on. After one minute, both systems ready but not responding.

A,B - Mode selections. Normally set to A. System will respond accordingly on interrogation, A & B both for identification, tracking and flight level.

CODE DIGITS SELECTOR SWITCHES. Four thumbwheel type switches select the code digits.

IDENT BUTTON. Pressed and released, this initiates an identity pulse response on modes A & B, lasting for not less than 20 seconds.

TEST BUTTON. This is pressed to operate the self-test circuits. Visual indication of serviceability is given on the Monitor Lamp, which should remain lit for 10-15 seconds.

MONITOR LAMP. In addition to the test response, this lamp lights when the transponder is responding with adequate power. It may also come on for 15-20 secs when S/B is selected from Off. This is not abnormal.

AR SWITCH. With this switch On, flight level response is given in Mode C provided A or B mode is selected.

1-2 SWITCH. Transponder selector. The unselected system

cont/...

remains in stand-by mode ready for instant response on selection.

TRANSPONDER UNIT (2). Mounted on shelf 7, electronics bay. This contains power supply, receiver, decoder, amplitude comparison, encoding and transmitting circuits. The receiver frequency is 1030 Mc/s and the transmitter 1090 Mc/s.

AERIALS (2). Lower fuselage centre line, labelled 'Transponder', No 1 fwd.

POWER SUPPLIES. 28V DC as shown in Chapter 5 Power Supplies

DISTANCE MEASURING EQUIPMENT

GENERAL. Two Collins 860E-3 installations form identical twin Distance Measuring Systems capable of providing indications of slant range up to 390 nm from the VOR/DME, Vortac or Tacan station being interrogated. Except for the aural call-signs of the ground station, received with NAV 1 or 2 selected at the Station Box, information from the two systems is presented on a dual Indicator.

Accuracy is +/-0.1nm at ranges up to 5nm with aircraft speed 200 kts or less. At ranges 5-380nm and speed above 200kts it is +/-0.2 nm.

CONTROLLER. This is featured in the Radio Nav Systems description where it is shown that selection of a VOR frequency selects also the paired DME channel. Switch positions not fully covered there are:-

STBY - Receiver on, four dashes on Indicator, ready for full operation in one minute.

DME - Range limited to 200 nm.

OVRD - Override. Maximum range.

If DME or OVRD is selected from cold, there is still a one minute delay before normal operation is obtained.

cont/...

NAV TEST SWITCH. With the system warmed up and a DME channel selected, the switch is operated momentarily to initiate the self-test function. If the system is serviceable the Indicator goes blank for one second, followed by four dashes for one second and finally four zeros for ten seconds. If the system is unserviceable then the indicator will remain blank. If an RCA AVQ70 DME unit is fitted in place of the Collins, 094.0 (+/-1) will be shown instead of 000.0

DISTANCE INDICATOR. A dual LED type Indicator is mounted centrally above coaming. This may show from 000.0 up to 399.9 The digits ae constructed of straight light bars. Any digit, except the hundreds, will be completely extinguished if a fault on a horizontal bar would otherwise cause an incorrect figure to be presented. At Stby and when no information is available, (e.g. if the ground station is inoperative or out of range), a dash is presented in place of each digit. With power off or system failure, the Indicator goes blank. The knob controls digit brilliance.

DME UNIT (2). These are carried in the electronics bay and may provide 252 channels. The transmitter frequency is 1025-1150 mc/s, the receiver 962-1213 mc/s.

AERIAL (2). Mounted on the lower fuselage, No. 1 foremost.

POWER SUPPLIES. Shown in Power Supplies, 115V single phase AC controlled by a 28V DC relay for each system.

FLIGHT RECORDER

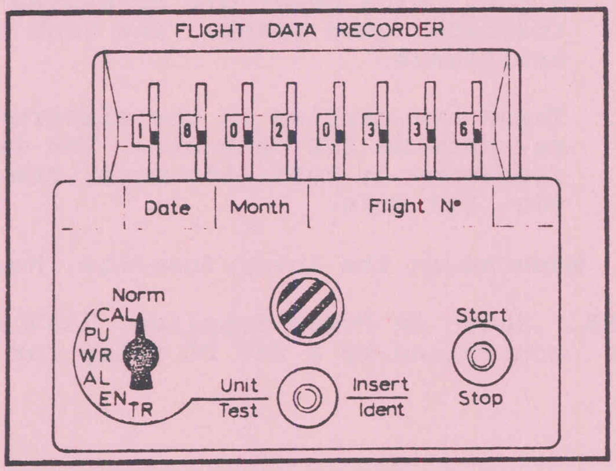
GENERAL. The Plessey-Davall flight recorder system records, in the form of binary coded digits against time:-

Roll attitude
Pitch attitude
Heading (C)
Radio height
Ht. lock
Speed lock
Gld grg. select

Flight level
IAS
Vertical accel.
Stick shake
Stick push
A/Throt eng.
Prime Land select

Engines 1 & 2 pwr
Flap position
GPWS warnings
A/P engagement
Tx switch opn
Ht acquire

Flight level, vertical acceleration airspeed and engine power are derived from the system's own transducers, heading is taken from the port compass system, pitch and roll from VG 3.



RECORDER CONTROLLER

CONTROLLER. Mounted on the port console, the Controller carries all the controls for normal operation as follows

Start-Stop switch. Spring loaded to centre, function self-evident but operative only on the ground. The switch is ineffective once the weight is off the undercarriage when an oleo switch starts the Recorder automatically if 'Start' has not already been selected. The oleo switch stops the Recorder about 64 seconds after touchdown.

Magnetic Indicator. This shows either 'ON' when the system is on and working normally, or orange and black stripes when off or faulty. Most failures will be indicated by its oscillating between one and the other. In this event the test switch should be used.

Date/Flight No. switches. Eight edge-operated rotary switches allow the date, month number and all four figures of the flight number to be set in the eight apertures. Zero is set to precede 3-figure flight numbers, 9999 for flights with no flight number.

Unit Test/Insert Ident switch. Sprung to centre off, when operated to Insert Ident and released, the recorder is switched on temporarily and the flight identification as set above will be recorded at least three times in place of any other information. The magnetic indicator will show 'ON' for 64 secs if there is no fault. This function is inhibited when airborne, to prevent loss of data.

The 'Unit Test' position is used, in conjunction with the adjacent rotary switch, to check individual units when a fault is indicated by an oscillating MI. The rotary switch is set to PU (Processing Unit) and WR (Wire Recorder) in turn (AL is inoperative) whilst the 'Unit Test' position is held. The MI will then show faulty at WR and PU if the PU is U/S, faulty at WR only if that unit is U/S, or ON otherwise.

The EN position is for Engine Data and is only operative on aircraft G-AVMR.

ACCELEROMETER. Mounted in the centre section underfloor. Range -5g to +5g, this is placed with its sensitive axis normal to the aircraft fore and aft and lateral axes, and provides the vertical acceleration output.

PROCESSING UNIT. Radio rack. This unit contains the flight level and airspeed transducers, the timing circuits and the circuitry concerned with converting the various information signals into a form suitable for recording and assembling them in the correct order. It also holds the system self-checking circuits.

RECORDING DECK. Mounted in the rear fuselage, this has two parts, the Drive Unit and the Cassette. The Drive Unit holds cassette drive motors, a power pack, two amplifiers and a device for controlling recording wire tension. The Cassette holds approximately 50 miles of 0.002 in. diameter stainless steel recording wire, sufficient for 300 hours recording, wire carriage and tensioning devices and erase, record and monitoring heads. It is designed to ensure that the record has a very good chance of surviving the worse crash.

QUICK ACCESS RECORDER. Mounted in the flight deck radio rack and operating in parallel with the Flight Recorder, this tape recorder records the same detail. It has up to 13 hours recording capacity on 7 tracks.

Inserting a partly used tape cassette resets the deck to track 1 at a point corresponding to the point on whichever track was being recorded when the cassette was removed. Thus, having just started on track 3, for example, if a cassette is removed and replaced, recording will re-commence at the start of track 1 thus erasing what was ontracks 1 and 2. If it were near the end of track 2 when removed and replaced, it would start again near the end of track 1 so only track 2 would be erased.

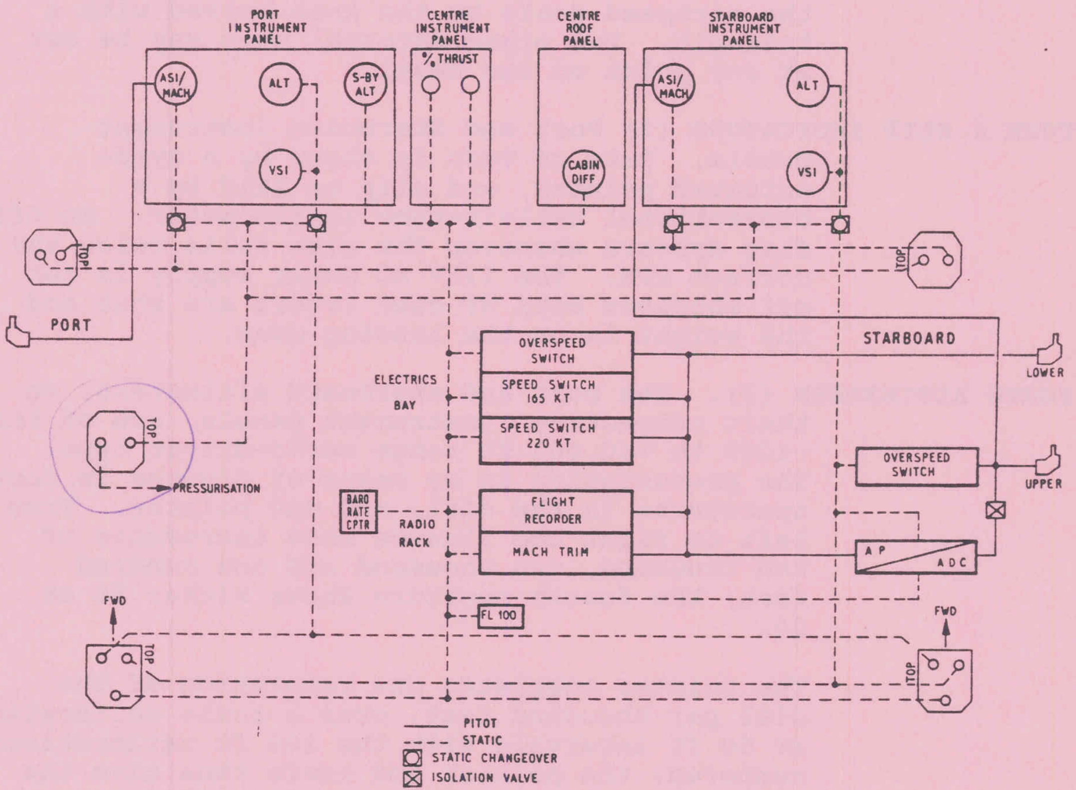
POWER SUPPLY. Single phase 115V 400 c/s from Radio 1 AC Bus.

FLIGHT INSTRUMENTS

PITOT/STATIC SYSTEM

GENERAL Pitot pressure for the ASI's, etc, is taken from one pitot pressure head on the port side of the forward fuselage and two on the starboard side; the air data sensor can be isolated from the system. There are an additional two pitot heads on the fin bullet.

Static pressure is taken from five vent plates on the forward fuselage, and it is possible to connect the flight instrument to an alternative source of supply. There are an additional two plates on the rear fuselage for the artificial feel system



PITOT/STATIC SYSTEM

STATIC CHANGEOVER VALVES (4). Two on the lower edge of the port instrument panel, two on the starboard panel. Marked 'ASI' and 'Air Data', with Normal and Alternative positions, and held on

CONT/...

the Normal position by spring guards. The Air Data valve controls the supply to the altimeter and VSI.

AUTOPILOT PITOT ISOLATING SWITCH. Under Free Fall Lever cover at foot of starboard console. When set to 'Isolate' cuts off the pitot pressure supply to the airdata computer.

ASI/MACHMETERS (2). Port and starboard instrument panels. Outer scale 60 to 200 kts then Mach No. Inner scale 200 to 400 kts over same arc as Mach scale. The setting of the Mach No. scale is adjusted by an altitude capsule in conjunction with the airspeed capsule. The pointer is waisted near the tip to permit the reading of both airspeed and Mach No.

The iternal triangular bug is set anywhere on the airspeed scale by the knob marked with a triangle. Two other external bugs may be set at any point on the bezel.

TURN & SLIP INDICATORS (2) Port and Starboard instrument panels. Rate of turn is shown by a gyro-actuated pointer, and slip or skid by a conventional ball-in-tube inclinometer. An Off flag appears whenever the gyro falls below the correct RPM. The 115V ac power supply is cut off whenever both HP cock levers are shut and the weight is on the landing gear.

SERVO ALTIMETERS (2). The port and starboard altimeters, on their respective instrument panels, are of the -1000 to +50,000 ft range servo-driven type. The presentation is by means of figures in four aperatures in the dial, and one pointer. From left to right the figures show increments of ten thousand, one thousand and one hundred feet; the fourth aperture shows either 50 or 00.

The pointer completes one revolution of the dial per thousand feet, over a scale calibrated at 50 ft intervals with the 100 ft calibrations numbered; the pointer and scale thus give the same information as the last three figures.

A sub-scale, calibrated in Mb is set by a knob at the lower left corner of the dial. A flag appears in the top half of the display if the instrument malfunctions or power fails.

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The aneroid capsule of a servo altimeter exerts no mechanical effort beyond that necessary to move a small metal bar which is part of an inductive pick-off; movement of this bar induces in the pick-off a signal which is amplified and used to drive a motor in the correct direction. The motor actuates the indicating mechanism and also a cam which returns the pick-off to a state of balance in which the signal is discontinued.

This instrument has greater accuracy and less lag than the non-servo stand-by altimeter, so discrepancies between tham can be expected. Altimeter tolerance figures are given in the Flying Manual.

Flight level signals for the Transponders are taken from the port altimeter.

STANDBY ALTIMETER (1) on the port instrument panel, is capsule-operated with a range of -1000 to 50,000 ft, and is connected to both of the three-vent static vent plates. This altimeter is of the two pointer and concentric arc type with a millibar scale adjusted by a knob on the lower left hand corner of the instrument

SERVO ALTIMETER TEST SWITCHES. (2). Outboard edge of each main instrument panel, these are for maintenance purposes only and should not be used in flight

FL100 WARNING LAMPS (2) Green, by each servo altimeter. Press to cancel. The lamp flashes when descending through FL100 (+/-500ft) until cancelled by pressing and releasing either lamp. The lamps will also flash until cancelled when power is first applied or after a power interruption.

STAND-BY HORIZON. On the port instrument panel. Fast erect button on the bottm left of the instument provide rapid erection of the gyro. It must not be pressed within 30 seconds of supplying power or for longer than one minute and should only be used with the aircraft straight and level. When it is pressed the fail flag at the top of the dial will apppear. The fail flag will also appear if the instrument or the power supply fails. The 115V AC power supply is cut off when both HP cock levers are shut with the weight on the landing gear.

STAND-BY COMPASS. Type E2B, mounted at the top of the centre windscreen pillar. It is internally lit, the switch being on the starboard roof panel.

TOTAL AIR TEMP GAUGE. Centre instrument panel, range -60 to +60°C. The temperature bulb is mounted on the lower port side of the nose. Power supply 28V DC. (A/c AVMR has an additional temperature probe on the upper stbd. side of the nose, associated with the engine data acquisition unit. This has no connection with the Flight Instrumentation.)

CLOCK An eight day clock with sweep second hands is mounted outboard of the starboard instrument panel. The glass is mounted in an adjustable bezel and carries a lubber mark. The winder knob is pulled out to set the hands.

STOPWATCHES (2), One on each main instrument panel. The shorter inner hand shows minutes up to 12, the longer hand shows seconds up to 60 on the outer scale. The push-button at the bottom of the dial resets the hands to zero and the knurled knob is used to wind, start and stop the stopwatch.

VSI's (2). Port and starboard instrument panels. The conventional type of instrument in which the lag in pressure equalisation in a very sensitive capsule is used to indicate the rate of change of altitude up to 6000 ft/min.

Both ADF systems or -
Both NAV systems or -
Either one of the ADF and NAV systems.

The RMI pointers have fed to them bearing information which is always relative to the heading of the aircraft so they will be seen to be pointing, in azimuth, towards the station concerned. Reference to a pointer against the fixed calibration pips outside the compass card will provide the relative bearing; reference to the same pointer against the compass card will provide the QDM. To make the VOR presentation at the pointers relative, synchros in the NAV system Instrumentation Unit, subtract the aircraft magnetic heading from the QDM provided by VOR.

One of the pointers is single-barelled (red) and presents the bearing information from ADF1 or NAV1; the other pointer is double-barelled (green) and presents the bearing information from ADF2 or NAV2. Input to the pointers is controlled by the ADF/VOR switches on the front of the instrument.

ALTITUDE ALERT SYSTEM

GENERAL. The Smiths Altitude Alert System presents audible and visible warnings of approach to, or deviation from, any pre-set altitude, flight level or height, depending on P2 Altimeter setting (539 - P1 setting). In the following description, reference will now be made only to altitude.

The system incorporates an Altitude Alert Unit with its own amber lamp, and two hooters. It also employs the amber lamp on the starboard servo altimeter (539 - both altimeters).

ALTITUDE ALERT UNIT. Mounted on the coaming panel. Includes an altitude read-out, a setting knob, an amber altitude warning lamp and a test button as detailed below. Integral lighting is controlled with centre instrument panel lighting (539 - P1 panel lights). The knob below the read-out allows the digits to be set to any altitude within the range -1000 to 49,000 ft., in increments of 100 ft. The last two digits are thus fixed zeros.

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With an altitude less than 10,000 ft set, the first digit place shows cross-hatch. A black/white striped flag covers the first three digits if the system AC or DC power is lost or the associated Servo Altimeter or its power supply fails.

The amber lamp operates in parallel with the other amber lamp(s) as detailed below. The test button is used only during maintenance.

OPERATION. 900 ft. on P2 altimeter before the selected altitude (539 - 700ft on P1 altimeter), all the amber lights will come on steadily and a 2 second note will sound on the hooters. 300 ft from the selected altitude the warning lights will go out.

If the aircraft is levelled whilst the lights are on, they will remain on indefinitely. If the vertical direction is reversed whilst the lights are on, they will remain on until the deviation from the selected altitude reaches 900ft when they will start to flash and the 2 second hooter will sound.

The lights will continue to flash until the aircraft returns to within 900 ft of the selected altitude when they will come on steady and the hooter will again sound. At 300 ft from the selected altitude the lights will go out.

DEVIATION FROM ALTITUDE. If the aircraft deviates by more than +/-300 ft from the selected altitude, a 2 second note will sound and the lamps will light until the selected altitude +/-300 ft is resumed or the Altitude Alert Unit is re-set to another altitude

ATC TRANSPONDER

GENERAL. The dual ATC Transponder system automatically responds to interrogation from the ground to provide aircraft control authorities with aircraft identification, tracking and flight level information. It may also be used to acknowledge ATC messages in the event of failure of aircraft R/T transmitters and to indicate that an aircraft is in distress. Range of the system with standard ground equipment exceeds 180 nm.

If the aircraft is levelled whilst the lights are on, they will remain on indefinitely. If the vertical direction is reversed whilst the lights are on, they will remain on until -

Manually cancelled or

The Altitude Alert Unit is reset to another altitude or

The aircraft goes beyond 5000 ft from the selected altitude.

DEVIATION FROM ALTITUDE. If the aircraft deviates by more than +300 ft from the selected altitude, a 2 second note will sound and the lamps will light until -

Manually cancelled or

The selected altitude +300 ft is resumed or

The Altitude Alert Unit is re-set to another altitude or

The aircraft goes beyond 5000 ft from the selected altitude.

TEST-CANCEL SWITCH. On the port instrument panel. At Test, the three amber warning lights flash. Cancel is selected momentarily to cancel warnings and reset the system.

CONTROLLER. On the pedestal, it has controls as follows:-

Mode switch. This allows standby mode, or mode A or B operation to be selected. For normal civil ATC operation mode A is selected. (400 aircraft also have mode C and D positions)

(400 & 539) (There is no standby position on the mode switch)

1-2 switch. This selects the system for use. when 1 or 2 is selected, the other remains at standby. (On 539 there is an additional standby position)

(400 only) (**On/standby/off switch.** This switch allows selection of on, off or standby. There is an additional position, 'Lo Sense' which is not used)

(539 only) (**Alt source switch.** This allows the port or starboard servo altimeter to provide the flight level signal for whichever transponder is selected.)

Alt rptg-off. With this switch at 'Alt Rptg', flight level response is given in mode C regardless of the setting of the altimeter. 539 aircraft take the height signal from the altimeter selected at the Alt Source switch, 400 aircraft use the port altimeter for transponder 1 and the starboard for transponder 2. The rest of the fleet use the port altimeter for both transponders.

Code Selectors. Two pairs of concentric switches select the code digits in the aperture above.

Ident button. Momentary pressure initiates a 20 second identity pulse response in modes A and B.

Test button. Momentary pressure causes the 'Reply' light to
come on for 15 seconds if the selected system is serviceable.

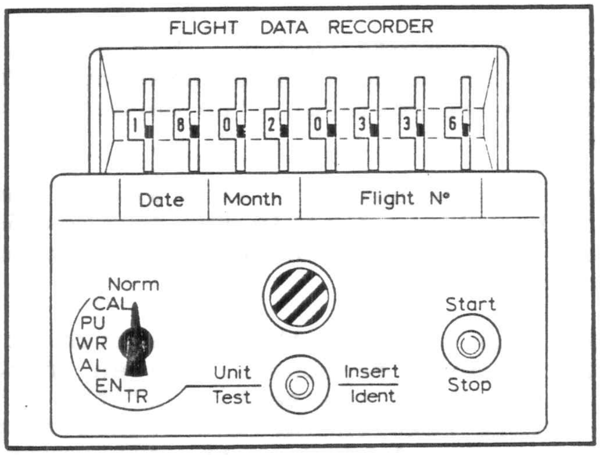
Reply lamp. This green light comes on when the system is responding to interrogation and as shown above on Test.

Fault lamp. (Not 400) This amber light comes on when certain faults are detected.

TRANSPONDER UNIT (2). Radio rack bottom shelf. This contains power supply, receiver, decoder, amplitude comparison, encoding and transmitting circuits. The receiver frequency is 1030 Mc/s and the transmitter 1090 Mc/s.

AERIALS (2). Lower forward fuselage centre line, No.1 forward.

POWER SUPPLIES. As shown in Chapter 5, Power Supplies, 115V single phase AC



FLIGHT RECORDER

GENERAL. The Plessey-Davall flight recorder system records, in the form of binary coded digits against time:-

Roll attitude
Pitch attitude
Heading (C)
Radio height
Ht. lock
Flight level
IAS
Vertical accel.
Stick shake
Stick push
Engines 1 & 2 pwr
Flap position
GPWS warnings
A/P engagement
Tx switch opn

Flight level, vertical acceleration airspeed and engine power are derived from the system's own transducers, heading is taken from the port compass system, pitch from the port FDI and roll from 1 (or 2) Gyro.

CONTROLLER. Mounted on the port console, the Controller carries all the controls for normal operation as follows

Start-Stop switch. Spring loaded to centre,

cont/...

function self-evident but operative only on the ground. The switch is ineffective once the weight is off the undercarriage when an oleo switch starts the Recorder automatically if 'Start' has not already been selected. The oleo switch stops the Recorder about 45 seconds after touchdown.

Magnetic Indicator. This shows either 'ON' when the system is on and working normally, or orange and black stripes when off or faulty. Most failures will be indicated by its oscillating between one and the other. In this event the test switch should be used.

Date/Flight No. switches. Eight edge-operated rotary switches allow the date, month number and all four figures of the flight number to be set in the eight apertures. Zero is set to precede 3-figure flight numbers, 9999 for flights with no flight number.

Unit Test/Insert Ident switch. Sprung to centre off, when operated to Insert Ident and released, the recorder is switched on temporarily and the flight identification as set above will be recorded at least three times in place of any other information. The magnetic indicator will show 'ON' for 32 secs if there is no fault. This function is inhibited when airborne, to prevent loss of data.

The 'Unit Test' position is used, in conjunction with the adjacent rotary switch, to check individual units when a fault is indicated by an oscillating MI. The rotary switch is set to PU (Processing Unit) and WR (Wire Recorder) in turn (AL is inoperative) whilst the 'Unit Test' position is held. The MI will then show faulty at WR and PU if the PU is U/S, faulty at WR only if that unit is U/S, or ON otherwise.

ACCELEROMETER. Mounted in the centre section underfloor. Range -5g to +5g, this is placed with its sensitive axis normal to the aircraft fore and aft and lateral axes, and provides the vertical acceleration output.

PROCESSING UNIT. Radio rack. This unit contains the flight level and airspeed transducers, the timing circuits and the circuitry concerned with converting the various information signals into

cont/...

a form suitable for recording and assembling them in the correct order. It also holds the system self-checking circuits.

RECORDING DECK. Mounted in the rear fuselage, this has two parts, the Drive Unit and the Cassette. The Drive Unit holds cassette drive motors, a power pack, two amplifiers and a device for controlling recording wire tension. The Cassette holds approximately 50 miles of 0.002 in. diameter stainless steel recording wire, sufficient for 300 hours recording, wire carriage and tensioning devices and erase, record and monitoring heads. It is designed to ensure that the record has a very good chance of surviving the worse crash.

QUICK ACCESS RECORDER. Mounted in the flight deck radio rack and operating in parallel with the Flight Recorder, this tape recorder records the same detail. It has up to 13 hours recording capacity on 7 tracks.

Inserting a partly used tape cassette resets the deck to track 1 at a point corresponding to the point on whichever track was being recorded when the cassette was removed. Thus, having just started on track 3, for example, if a cassette is removed and replaced, recording will re-commence at the start of track 1 thus erasing what was on tracks 1 and 2. If it were near the end of track 2 when removed and replaced, it would start again near the end of track 1 so only track 2 would be erased.

POWER SUPPLY. Single phase 115V 400 c/s from 2 Main AC Bus.

FLIGHT INSTRUMENTS

PITOT/STATIC SYSTEM

GENERAL Pitot pressure for the ASI's, etc, is taken from one pitot pressure head on the port side of the forward fuselage and two on the starboard side; the air data sensor can be isolated from the system. There are an additional two pitot heads on the fin bullet (400 - either side of the fin) for the artificial feel system

Static pressure is taken from five vent plates on the forward fuselage, and it is possible to connect the flight instrument to an alternative source of supply. There are an additional two plates on the rear fuselage for the artificial feel system

STATIC CHANGEOVER VALVES (4). Two on the lower edge of the port instrument panel, two on the starboard panel. Marked 'ASI' and 'Air Data', with Normal and Alternative positions, and held on the Normal position by spring guards. The Air Data valve controls the supply to the altimeter and VSI.

AUTOPILOT PITOT ISOLATING SWITCH. Under Free Fall Lever cover at foot of starboard console. When set to 'Isolate' cuts off the pitot pressure supply to the airdata computer.

ASI/MACHMETERS (2). Port and starboard instrument panels. IAS and Mach number are indicated by the white pointer aginst the fixed IAS scale and the moving Mach scale which rotates anti-clockwise with increasing height.

The red and white striped VMO Pointer is fixed at 327kts IAS (400 - 353kts) until MMO is reached after which, if the climb is continued at MMO, it will begin to move anti-clockwise. If the IAS and VMO pointers coincide, a switch is operated to sound the high speed warning bell.

(539 only) (The VMO Pointer is variable and is set on the ground, within the range 315 to 352 kts IAS, by the VMO Ground Set knob which must be pulled out to turn.)

The internal triangular bug is set anywhere on the airspeed scale by the knob marked with a triangle. Two other external bugs may be set at any point on the bezel. Power supply is 28V from DC Main Bus.

SERVO ALTIMETERS (2). The port and starboard altimeters, on their respective instrument panels, are of the -2265 (400 - -1000) to +50,000 ft range servo-driven type. The presentation is by means of figures in four aperatures in the dial, and one pointer. From left to right the figures show increments of ten thousand, one thousand and one hundred feet; the fourth aperture shows either 50 or 00. Below 10,000 ft the first aperture shows a black and white striped flag. The pointer completes one revolution of the dial per thousand feet, over a scale calibrated at 20 ft intervals with the 100 ft calibrations numbered; the pointer and scale thus give the same information as the last three figures.

Two sub-scales, calibrated in In. Hg and Mb are set by a knob at the lower right corner of the dial. An amber lamp at the top left corner of the dial is associated with the Altitude Alert (where fitted). An orange/black flag covers the digit read-out if the instrument malfunctions or power fails. The PE correction fail flag (C) may be disregarded; there is no correction.

The aneroid capsule of a servo altimeter exerts no mechanical effort beyond that necessary to move a small metal bar which is part of an inductive pick-off; movement of this bar induces in the pick-off a signal which is amplified and used to drive a motor in the correct direction. The motor actuates the indicating mechanism and also a cam which returns the pick-off to a state of balance in which the signal is discontinued.

This instrument has greater accuracy and less lag than the non-servo stand-by altimeter, so discrepancies between tham can be expected. Altimeter tolerance figures are given in the Flying Manual.

Flight level signals for the Transponders are taken from either altimeter, as selected on the transponder. Indicated altitude (flt level or ht) for the Alt Alert are taken from the starboard instrument (539 - port instrument). Power supply is 26V AC.

STANDBY ALTIMETER (1) on the starboard instrument panel, is capsule-operated with a range of -1000 to 80,000 ft, and is connected to both of the three-vent static vent plates. This altimeter is of the three pointer type with a millibar scale adjusted by a knob on the lower left hand corner of the instrument

(539 only) (The presentation is the same as the servo altimeters but there is no amber lamp. A flag indicates failure of vibrator or its power supply and thus reduced accuracy.)

ALT GROUND TEST ONLY BUTTONS (2). One adjacent to each servo altimeter, these are for maintenance purposes only and should not be used in flight (not 400)

STAND-BY HORIZON. This is a SFENA 705-7V93 instrument with complete roll freedom. Pitch freedom is 100° in climb and 70° in dive. A roll brake keeps the gyro within 70o of level when power is off. The roll pointer and scale are at the top of the dial and thus, like the FDI, show the roll demand for level flight, not a statement of roll attitude. The roll scale is calibrated in 10° increments from 10° to 60° either side of zero.

The pitch presentation is in the form of a drum with the upper half blue and the lower half black. The climb scale is calibrated at 5° intervals up to 20° then at 30°, 40°, 60°, 80°, with the word Up at the last three marks. The 90° climb limit mark has a star.

The dive scale is the same except that the word DOWN is shown at the 40° and 60° marks and a small square is shown at 70° the cale limit.

Fail Flag. This is a fluorescent red and white cross and appears on the right hand edge of the dial whenever power is less than 70V.

Caging - Erection Control Knob. The gyros erection rate is about 2.7°/min; pulling the knob cages the gyro, reduces the erection time and clears the fail flag at switch-on.

(400 only) (The standby horizon has a black background with a white horizon bar. Press the fast erect button for rapid erection, (not within 30 secs of power on or for longer than 1 minute). Roll freedom is unlimited, pitch freedom +/-70°.)

STAND-BY COMPASS. Type E2B, mounted at the top of the centre windscreen pillar. It is internally lit, the switch being on the port roof panel.

TOTAL AIR TEMP GAUGE. Centre instrument panel, range -70 to +50°C, ratiometer type. The temperature bulb is mounted on the lower port side of the nose. Power supply 115V AC.

CLOCK/STOPWATCH (2). An eight-day and elapsed time clock is mounted one in each main instrument panel. The large hands are set by moving the lever on the side of the clock up then turning the control knob. If the knob is turned with the lever in the down position it serves as the winder for the clock. The knob is pressed to start, stop and zero the sweep second hand and lower 'Min' hand.

VSI's (2). Port and starboard instrument panels. The conventional type of instrument in which the lag in pressure equalisation in a very sensitive capsule is used to indicate the rate of change of altitude up to 6000 ft/min.

TURN & SLIP INDICATORS (2) Port and Stbd. instrument panels.
(Not 400/539) Rate of turn is shown by a gyro-actuated pointer, and slip or skid by a conventional ball-in-tube inclinometer. An Off flag appears whenever the gyro falls below the correct RPM.

FIRE PROTECTION
ENGINE FIRE DETECTION SYSTEM

ENGINE FIRE WARNING LAMPS (2), red, in fire control handles on glareshield, marked '1', '2'. Two bulbs in parallel in each handle will light when the Firewire in Zone 1 of the associated engine is subjected to an excessive temperature. In addition, a red lamp will light in the head of the appropriate HP cock lever, provided it is not at Shut. The lamps will go out when the temperature falls below the critical value.

FIRE BELL, (1), on flight deck roof. Operated in conjunction with the engine fire warning lamps by the Firewire in Zone 1.

FIRE BELL ISOLATION SWITCH/LAMP (1), pull to test, on centre instrument panel, marked 'Firebell pull to isol'. When pulled to isolate the bell, an amber lamp lights in the head of the switch. If subsequently pressed in the lamp will go out and, if a fire warning lamp is still lit, the bell will resume ringing.

ENGINE FIRE PROTECTION

FIRE CONTROL HANDLES (2), on glareshield, one for each engine, marked '1', '2'. Pull and then turn clockwise for first extinguisher shot, anti-clockwise for second shot, as indicated on the handle. When pulled, the hydraulic and air isolation valves close and, if the HP cock lever is at 'Shut', the LP cock also closes.

FIRE EXTINGUISHERS (2). Two bottles, each containing 6lb of BCF (Bromochlorodifluoromethane) are mounted on the port side of the rear face of the rear pressure bulkhead, and are accessible from the ventral stairway. Each bottle has two heads and can be discharged into Zone 1 of either engine. When a bottle has been discharged, an indicator pin protrudes from the head that has been fired.

FIRE BOTTLE DISCHARGE INDICATORS (2), on centre insturment panel, (510 on centre roof panel,) marked 1, 2. Latching magnetic indicators showing amber or 'FIRD'.

FIRE ACCESS PANELS (2), one on outboard side of each engine cowling, to provide firefighting access to Zone 1 in the event of an engine fire on the groud; they are painted red.

FIRE EXTINGUISHER PRESSURE RELEASE INDICATORS (3), on fuselage side below port nacelle fairing. Normally show a small green disc, but if the associated bottle has discharged as the result of excessive temperature a red bowl is visible; the foremost indicator is connected to bottle No.1, and the middle indicator of the three to bottle No.2. (The rearmost indicator is for the APU bottle)

FIRE HANDLE TEST SWITCHES (2), on centre instrument panel. Spring-loaded off (up), down 'Test'. Marked 'No.1', 'No.2', When a switch is set to 'Test', the fire bell rings and the appropriate fire warning lamps illuminate if the detection system is serviceable. When No.1 or No.2 switch is held at Test, the lamp in the appropriate HP Fuel lever will also light, unless the lever is at 'Shut'. If the test switches are used in flight the Firewire temperature may be so high as to prevent the system from re-setting until the engine cools down or the Fire Detector CB is pulled and reset.

APU BAY FIRE DETECTION AND PROTECTION

APU FIRE WARNING LAMPS (2), red. One in fire control handle on glareshield, one on APU external control panel. Two bulbs in parallel in the fire control handle and one on the external panel will light when the Firewire in the APU bay is subjected to an excessive go out and the bell will stop ringing when the temperature falls below the critical value.

FIRE CONTROL HANDLE (1), on glareshield, marked 'APU'. When pulled the LP cock closes and the electrical control is isolated, stopping the APU. After waiting ten seconds to allow the rpm to fall, the handle can then be turned in either direction to discharge the extinguisher.

FIRE SHUTDOWN SWITCH (1), on APU external control panel. Up 'Normal', down 'Fire'. When set to 'Fire' the LP

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cock closes, the electrical control is isolated to stop the APU, and the Fire Bottle switch is electrically armed.

FIRE BOTTLE SWITCH (1), on APU external control panel. Up off, down 'Extinguish'. When set to 'Extinguish' after the Fire Shutdown switch has been set to 'Fire', and not otherwise, the fire bottle will discharge.

MANUAL-FIRE AUTO SWITCH (1), on centre roof panel. When in either position the fire control handle and the fire switches on the external panel function normally. When at 'Fire Auto' these are supplemented by an automatic extinguishing circuit which, on receipt of a fire warning, shuts down the APU and, after a 12 second delay, fires the extinguisher bottle.

FIRE EXTINGUISHER (1). One bottle, containing 2lb of BCF, is mounted on the fin frame, port side. An indicator pin protrudes from the head of the bottle when it has been fired.

APU FIRE HANDLE TEST SWITCH (1), on centre panel, marked 'APU'. Up 'Off' down 'Test', spring loaded to off. Operates in a similiar way to the engine fire test switches except that before operating the APU test switch, the APU Manual-Fire Auto switch must be at Manual (when at fire Auto the test switch is isolated).

If the Manual/ Auto switch is selected to Auto while the test switch is held to test the APU fire bottle will be discharged.

FIRE BOTTLE DISCHARGE INDICATOR (1), on centre panel, marked 'APU'. A latching magnetic indicator showing amber of 'FIRD'.

FIRE ACCESS PANEL (1), in APU access panel under tailcone. Provides extinguisher access to the bay in the event of an APU fire on the ground, or pressure relief in the event of an explosion in the bay. It is painted red.

FIRE EXTINGUISHER PRESSURE RELEASE INDICATOR (1), the rearmost of the three on the fuselage side below the port nacelle fairing. Normally shows a small green disc, but if the bottle has discharged as the result of excessive temperature a red bowl is visible.

FUSELAGE FIRE PROTECTION

PORTABLE EXTINGUISHERS. For locations, see Safety Equipment.

BCF (3), for use on electrical or fluid fires.

Water glycol (1), for use on fires which do not involve electrical equipment or inflammable liquids and for 'damping down' after using BCF.

SMOKE GOGGLES (3), in stowage on port console and rear starboard bulkhead may be used by the flight crew, if the flight deck should fill with smoke or fumes. Worn with an oxygen mask, and will fit over spectacles if necessary.

(510 Only) (Only one pair of goggles is carried, in the port console stowage, for the use of the jump seat occupant - see smoke masks)

SMOKE HOODS (3) - See Air Conditioning chapter.

SMOKE MASK (1), for use with 310 litre portable oxygen cylinder.

(510 Only) (Two smoke masks are carried, on the port console and behind P2's seat. In the event of smoke on the flight deck they can be plugged into sockets on the oxygen drop out box, in which case they also allow use of the R/T and intercom via an integral microphone. Either mask may also be used with the 310 litre oxygen bottle)

ASBESTOS GLOVES (3 pairs) stowed above smoke hood cases.

TOILET COMPARTMENT AUTOMATIC EXTINGUISHER A self-contained automatic BCF fire extinguisher and 2 temperature sensitive discharge nozzles are located in the cabinet area of each toilet compartment. The system is independent of the toilet smoke detecting system.

Should the system detect excessive temperature in the toilet compartment waste container or toilet water heater compartment, it will release a quantity of BCF extinguishant into the appropriate area. No test facility is fitted.

PRIMARY FLIGHT CONTROLS

GENERAL. Aileron, rudder and elevator are all dual controls, movement of which is transmitted by cable runs and rods to the elevator and rudder control jacks, and to the aileron spring/servo tabs. The elevators are individually moved by tandem jacks, powered by Nos.1 and 2 Systems, the ailerons by the aerodynamic forces produced by servo tab deflection. Aileron control is normally assisted by differential extension of the speed brakes on each outer wing.

AILERONS. The aileron handwheels are interconnected, and each connected by a cable run to one aileron servo tab. The ailerons are interconnected by cable to prevent excessive up-float, provide an alternate control path to an aileron affected by failure of its control cable run or linkage, and ensure symmetric aileron movement.

The servo tabs are hinged to the ailerons, connected directly to the control input cable run and by torsion bars to the wing (stbd side) or to the trim jack on the wing structure (port side). The torsion bars oppose movement of the servo tabs, to provide additional feel and self-centring.

A cross shaft interconnects the operating pulleys moved by the handwheels, and is also connected to the auto-pilot servo drive. Quadrant pulleys in each control cable run feed aileron demands to the spoiler mixing units. Aileron gust dampers, hydraulic dash-pots, protect the system against damage from gusts whilst on the ground, by providing a resistance proportional to the rate of control surface deflection; in flight this applied resistance is negligable, in comparison with the leverage produced by the servo tabs. If the ailerons are fully deflected, the transfer rate of the fluid between chambers is further restricted, and a steady force of up to 120 lb applied for several seconds may be required to move the ailerons toward centre whilst on the ground; the required force may be greater if the aircraft has been standing for some time in strong sunlight and the units become heated.

ELEVATORS. Movement of the interconnected control columns is transmitted by twin cable runs and connecting

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linkage to the control valves of the tandem jack which drive the elevator: each elevator surface is moved by its own jack, assisted by the deflection of a geared tab, and each jack section is supplied individually from a separate hydraulic power system.

With one or both hydraulic power system pressures available, control movement opens both rotary valves on each tandem jack; resulting movement of the jack body along the fixed piston is transmitted to the elevator, and progressively restores the rotary valves to the neutral (locked) position. If one hydraulic system fails or is isolated, the affected section of each jack freewheels. If one rotary valve seizes or its input linkage fails, the jack will be moved by the remaining section, collapsing a spring strut in the operating linkage; this operates a micro switch, closing an isolate valve to cut off hydraulic pressure to the failed section, and switching on the Servo Fail warn lamp in the head of the associated Hydraulic Cut-Off Lever.

The autopilot elevator servo drive is connected to the stbd control run. Stick shaker, stick pusher, and elevator feel units are incorporated in the control system. When weight switches on the undercarriage legs are operated by the aircraft's weight, and system No.1 depressurised, tandem jack valves of No.1 System both revert to a 'gust damping' mode, and bring on the Gust Damper Engaged lamp.

Rudder. Rudder control is effected by a system similar to that operating the elevators, except that rudder pedal movement is transmitted to and operates two single hydraulic jacks, the lower powered by No.1 System, the upper by No.2. The autopilot servo motor is connected to the input cable run. With both hydraulic systems depressurised, the rudder jacks operate automatically in the gust damping mode. In the event of failure or isolation of both hydraulic systems, full manual reversion is available; but control loading is high, with lag caused by lost motion in the control linkage.

RUDDER & ELEVATOR FEEL. is provided by feel units. Each feel unit comprises two hydraulic jacks controlled by pitot/static pressure, and an equalising

cont/...

linkage connecting the jack rams to the control cable runs; the equalising linkage maintains the feel rate in the event of one jack losing its operating pressure, and varies its mechanical advantage with control deflection. With the aircraft on the ground, the jack pressures are controlled to give a resistance to movement equivalent to an indicated airspeed of 110 kt, and to give control centring. As airspeed increases above 110 kt the jack pressures are progressively increased, imparting increasing resistance to ram movement and consequently control deflection up to a maximum equivalent to 330 kt IAS.

Flight loads are simulated by a combination of control surface angle and airspeed variation sensed by pitot/static connections to the feel unit. Pitot heads are fitted to each side of the fin bullet, (either side of the fin on the 400) and static vent plates are located on each side of the lower fuselage beneath each engine.

The Elevator feel unit additionally comprises a third hydraulic jack powered by the Emergency Elevator system, providing a fixed feel equivalent to 180 kt IAS. (150kts on the 400)

FEEL FAIL WARNING LAMP (1), amber, on the port instrument panel. (Hydraulics panel on the 510.) On when either hydraulic jack in the rudder feel unit moves abnormally in relation to the other jack. (510 only) (Connected to the Amber MWS.)

SERVO FAIL WARNING LAMPS (2), red, on the head of each hydraulic cut-off lever (see below). On when any of the micro switches, mounted on the spring struts connecting the control input to the control valves of the rudder and elevator jacks and the TPI and Flap hydraulic motors, are operated by collapse of a strut in the event of control valve seizure.

With the exception of the control valves for the Flap motor, which have to be isolated by shutting the appropriate Hydraulic cut-off valve, the affected control valve is automatically isolated, as the warning signal actuates an isolate valve to shut off system pressure to that jack or jack section; the isolated unit will now 'free-wheel', and the control surface is moved by the remaining unit powered by the unaffected hydraulic system.

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Each lamp is connected to the Master Warning system. If the lamp comes on, the parent lever must be moved to the aft 'off' position, cutting off hydraulic system pressure to the rudder jack, elevator jack sections, flaps motor, TPI drive motor, feel unit jacks, and spoiler jacks (inner or outer) supplied by that system. The lamp goes out, and the Master Warning is cancelled.

SERVO FAIL TEST SWITCH (1), push-button type, on centre console. When pressed, completes a test circuit through the Servo Fail warning lamps on the hydraulic cut-off levers, provided the levers are at the 'Off' position; if either lever is in the 'On' position, the associated warning lamp should not come on when the switch is operated.

(400, 510 &)
(539 only) (This switch incorporates a green Emergency Elevator Selected lamp.)

HYDRAULIC CUT-OFF LEVERS (2), on centre console. Fwd 'On', aft 'Off', controlling the servo power valves of Nos. 1 and 2 hydraulic power systems. When selected 'Off', depressurises the flight control hydraulic jacks and motors supplied by that hydraulic power system; port lever - No.1 System, stbd - No.2.

RUDDER PEDAL ADJUSTERS (2), one on each side console. Pull to release the associated set of rudder pedals for reach adjustments.

AILERON TRIM KNOB (1), on centre console. Turn anti-clockwise 'Lower port wing', clockwise 'Lower stbd wing', scale graduated 0-10 divisions to either side of 12 o'clock - neutral. Connected by cable run and quadrant pulley to the trim jack. Rotation of the knob winds up the torsion bar connected to the port aileron servotab, to produce a spring loading against the servo tab; if the aileron hand wheel is held, this loading is felt as a wing-heavy reaction; when the handwheel is released, the servo tab is deflected until the ailerons have moved to the new trimmed neutral position.

RUDDER TRIM KNOB (1), on centre console. Turn left 'Nose port', turn right 'Nose stbd'. Scale graduated 0-10 divisions to either side of 12 o'clock - neutral. Connected by cable run to feel simulator linkage; when the knob is

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turned, the neutral point of the linkage is displaced, causing the pressure exerted by the feel jacks to drive the linkage to the rudder jack control valves until the rudder reaches the new trimmed position.

TAIL TRIM HANDWHEELS (2), on either side of centre console, inter-connected. Rotate fwd 'Nose down', aft 'Nose Up'. Concentric scales graduated U1-U10, neutral (white arrow head), 1D-2D, registering against a white mark on each wheel mounting to show selected tailplane incidence; permitted take-off range indicated by a white band.

The hand wheels are connected by a clutch to a cable run terminating at the selector valves of two hydraulic motors in the TPI drive unit; each motor is powered by a different hydraulic system via servo cut-off valves and individual isolate valves.

Handwheel rotation moves both selector valves, to energize both hydraulic motors, releasing their hydraulic locks, and initiating movements of the tailplane in the desired direction. A follow-up linkage restores the selector valves to the neutral position as the tailplane reaches the selected incidence, and the motors are hydraulically locked against further motion. If one hydraulic system fails, or the motor is isolated, the affected motor is free to rotate; if both systems fail or both motors are isolated, the tailplane drive screw is braked to prevent further movement.

In the event of selector valve failure, the spring strut connecting that valve to the cable run is collapsed, operating the isolate valve, removing the hydraulic lock on that motor, and switching on the Servo Fail warning lamp on the Hydraulic Cut-Off lever.

TAILPLANE INCIDENCE POSITION INDICATOR (1), on centre instrument panel. Electrically actuated by a transmitter on the tailplane, indicating achieved setting of tailplane. Graduated 0-11 divisions Nose Up, 0-2 divisions Nose Down. White sector shows permitted take-off range.

ELEVATOR TRIM SELECTOR SWITCHES (2) on centre console. Caged, spring loaded to centre 'Off', held fwd 'Nose Down', aft 'Nose Up'. Holding both switches fwd or aft energises an electric motor

cont/...

to move a trim tab on the port elevator. This system may only be used when normal trimming by tailplane incidence is inoperative and the flying controls are being operated by manual reversion.

ELEVATOR TRIM TAB POSITION INDICATOR (1), on centre instrument panel, graduated in divisions of Nose Up or Down trim. Electrically indicating setting of port elevator trim tab.

ELEVATOR GUST DAMPER ENGAGED LAMP (1), on hydraulics control panel, green. On when the No.1 System sections of the elevator tandem jacks revert to the gust damping mode following depressurisation of that hydraulic system on the ground.

ELEVATOR EMERGENCY SELECTOR SWITCH (1), on centre console. Guarded, fwd 'Off', aft 'Emerg'. In the event of failures causing the loss of hydraulic power to both flying control systems by closure of both hydraulic cut-off levers, the elevators can be powered by the emergency system.

Selecting 'Emerg' reverses the positions of the two valves in the supply lines to No.2 Aux pump, to shut off the line from the main reservoir and open the line from the No.2 emergency reservoir, energises the No.2 Aux pump, and energises the Emerg selector valve which opens a line to the No.2 system sections of the elevator tandem jacks via a shuttle valve. Return fluid from the elevator jack sections now powered is directed into a return line to the emergency reservoir. No.2 Aux pump pressure is also supplied to the emergency feel jack in the elevator feel unit, to provide a constant feel equivalent to an IAS of 180 kt. (150kts on the 400.)

(400/510/539 only) (When the switch is at Emerg, the Emerg Elev Selected lamp will be on.)

ELEVATOR EMERGENCY LP WARNING LAMP (1), amber, on centre console. On when hydraulic pressure in the emergency elevator system falls below 1,500psi with the Elevator Emergency selector switch selected 'Emerg'.

(510 only) (Connected to the amber MWS)

EMERG ELEVATOR SELECTED LAMP (1), green, on servo fail lamp test switch (centre console). Comes on when the emergency elevator system is selected.
(400/510/539)

DIFFERENCES
400/515/523/528/539

400

FLAP SELECTOR LEVER (1), on centre console, moving in quadrant engraved fwd 'Up' through 3°, 8°, 18°, 26°, to fully aft 45°.

515/523/528/539

FLAP SELECTOR LEVER (1), on centre console, moving in quadrant engraved fwd 'Up' through 6°, 13°, 20°, 26o to fully aft 45°.

ELEVATOR EMERGENCY FAIL LAMP (1), red, on centre console. On when seizure of the control valve for the section of either elevator tandem jack powered by No.2 collapses the spring strut, with the Elevator Emergency selector switch selected 'Emerg', and energises the Emergency Selector valve to isolate and depressurise the emergency system; the Aux pump should be switched off by selecting the Elevator Emergency selector switch 'Off'. Connected to the Master Warning system.

SERVO POWER VALVE MAGNETIC INDICATORS (2), on hydraulics panel. Display in-line indication:- associated valve open, cross-line:- asssociated valve shut.

FLAPS

FLAP SELECTOR LEVER (1), on centre console, moving in quadrant engraved fwd 'Up', through '8o', '18o', 26o', to fully aft '45o'. A cable run connects the selector lever to the linkage actuating the two flap motor control valves. Each flap motor is powered by a separate system, the flap motor powered by No.2 System can be operated in emergency by No.2 DC pump drawing fluid from the sump of No.2 System reservoir.

With the control valves in the neutral position, the motors are hydraulically locked. When the selector lever is moved, the control valves are opened and both motors rotate the primary flap drive shaft; this rotation is transmitted by bevel gears to the screw jacks moving the flap sections, and to the follow-up system. As the flaps reach the selected position, the follow-up system returns both control valves to neutral, and the hydraulic lock in each motor is restored. Special care must be taken to ensure that the selector lever is properly gated when making an Up selection.

Each control valve linkage incorporates a spring strut; if the control valve seizes, the spring strut is collapsed and operates a micro switch to illuminate that system Servo Fail warning lamp and arm the Master Warning system. When the appropriate Hydraulic Cut-Off Lever is pulled fully aft, the warning lamps are

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cancelled, the failed motor is able to rotate freely once system pressure is dissipated, and the remaining hydraulic motor will continue to operate the flaps at a reduced rate. If both motors lose hydraulic pressure, the primary flap drive shaft is automatically braked to prevent further flap movement, and further flap selections are only available via the emergency system.

Following failure of both hydraulic power systems, selecting the DC Pump switch to 'Emerg Flap' will energise the motorised emergency flap selector valve to open a line from the DC pump via a shuttle valve to the No.2 System hydraulic motor, and switch on the DC pump. A selection of 18/20o flap from 'Up', using this system, can be made using the flap selector lever normally; it will take 4-4.5 minutes to achieve this setting. This system must not be used to attempt a selection greater than 18o, as the DC pump is only rated for 5 min continuous operation (though the 539's is continuous rated) and the rate of flap travel is very low.

FLAPS POSITION INDICATOR (1), on centre instrument panel. Scale marked '0o', '3o', '8o', '18o', '26o', '45o', with white rectangles. (400, 501, 510 and 530.) or'0o', '6o', '13', '20', '26', and '45'. (515, 523, 528 and 539).
In addition to the flaps position indicator, there are incidence markings on the port and stbd centre flaps, showing the achieved flap setting when the appropriate marks are aligned with the mainplane trailing edge.

FLAP SHAFT FAIL WARNING LAMP (1), amber, on centre instrument panel. If either primary transmission shaft fails, a secondary transmission shaft on that failed side will engage the flaps drive screw jacks. The secondary transmission system normally lags fractionally behind the primary transmission, maintaining separation of clutch dogs; as this lag is taken up, the dogs engage to drive the flap sections, and a microswitch is operated to illuminate the warning lamp.

FLAP OVERSPEED WARNING LAMP. (510 only) (1) amber, on stbd. instrument panel. The lamp will come on if the flaps are selected to 8 degrees or more, and the airspeed exceeds 220+/-3 kts. Connected to the amber MWS

SPOILERS AND LIFT DUMP

SPEED BRAKE LEVER (1), on centre console, moving in quadrant engraved '0o', '10o', '20o', '30o', '40o', and '50o Lift Dump' from fully fwd to fully aft. The quadrant is gated at the '20o' position, and to achieve a selection greater than 20o a lever latch has to be withdrawn by pulling up the sliding handle of the lever from the 'Flight' position to the 'Ground' position. The lever is connected by a cable run to the port and stbd mixing units, and by a lever to the lift dump control valve; each mixing unit also receives inputs from the aileron control cable run, and is connected by rods and spring struts to the control valves of the two jacks operating the two speed brake surfaces on that outer wing. The outer jacks are supplied by No.1 System, the inner by No.2 System.

With the ailerons in the neutral position, a speed brake selection opens all four jack control valves; the jacks extend the speed brake surfaces until the feed-back linkage between each surface and the associated jack control valve closes the control valve when the selected angle is achieved.

With the speed brakes extended, movement of the aileron handwheel is transmitted to the mixing units, mechanically combining the speed brake and aileron inputs, to produce asymmetric extension of the port and stbd sections. With the speed brakes retracted, aileron control movements will progressively extend both sections on the down-going wing.

LIFT DUMP surfaces, one on each inner wing, are extended by hydraulic jacks powered by No.1 System pressure. When the speed brakes are selected to the '50o Lift Dump' position, the lift dump selector valve in the hydraulic power line is opened, and compression of both main oleo legs will operate micro-switches, admitting hydraulic pressure to the lift dump jacks to extend both surfaces. The lift dumper surfaces retract when the speed brake lever is moved fwd from the 50o position. If No.1 System pressure is lost, the outer pair of speed brake surfaces and the lift dump system will be inoperative; if No.2 System fails, the inner pair of speed brake surfaces will be inoperative. Seizure of a speed brake control

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valve collapses the spring strut connecting the control valve to the input linkage. When either hydraulic system is isolated or depressurised, the affected pair of spoiler surfaces will, if extended, be blown back; if the spoilers are extended beyond 20o at too high an airspeed, they will be blown back to less than the selected position.

SPOILER FAIL WARN LAMPS (2), on hydraulics panel, amber, On when collapse of the spring strut connecting one of the spoiler jack control valves supplied by the associated hydraulic system operates the microswitch attached to that box. The port, No.1 System lamp indicates failure of an outer jack, the stbd, No.2 System lamp an inner jack. If either lamp comes on, the appropriate spoiler isolate switch should be selected 'Off'.

(510 only) (Connected to the amber MWS.)

SPOILER ISOLATE SWITCHES (2), on hydraulics panel. Up 'On', down 'Off'. When selected Off, energises the appropriate isolate valve in the hydraulic power line to the outer (No.1 System) or inner (No.2 System) speed brakes jacks, to cut off the hydraulic power to that pair of jacks; the associated Spoiler Fail warning is cancelled

LIFT DUMPER MAGNETIC INDICATORS (2), on centre instrument panel, one for each surface. Indicate:

PWR OFF - No electrical power
Blank - Electrical power available surface retracted
OUT - Lift dump surface extended.

STALL WARNING AND RECOGNITION

GENERAL DESCRIPTION. Operation of the stall recovery and warning system is triggered by four sensor vanes, two either side, mounted half way up the fuselage ahead of the wing. The fwd pair of sensors control the Stall Rec systems, the rear pair the Auto-Ignition and Stall Warning systems. Rotation of the aft pair of incidence sensors, by increasing angle of incidence during stall approach, triggers Nos. 1 and 2 Auto-Ignition systems; No.1 system switches on igniters on both engines and is triggered by the port rear sensor, No.2 a second system of

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igniters when triggered by the stbd rear sensor.

The angle at which the systems are triggered is reduced by increased rate of change of incidence, and also varied by the setting of the Datum Advance/Fuel Dip switches. Decreasing incidence during stall recovery de-energises both systems when the triggering angle is reached, switching off the engine igniters.

Under normal conditions, if an approach to the stall is continued after the auto-ignition systems have been triggered, the further movement of the rear incidence sensors will trigger Nos.1 and 2 Stall Warning systems. No.1 system is connected to the stick shaker unit on the Captain's elevator control column, No.2 to the Second Pilot's. A priority circuit allows the first system triggered to operate its shaker unit, holding the second triggering signal. Both control columns are vibrated and knocked by the operation of either shaker unit.

The angle of incidence at which the stall warning systems are triggered is varied by the rate of change of incidence, lowering the angle if the stall is approached rapidly, and by the selected flap setting. The stick shaker triggering signal additionally arms the control circuit for the pneumatic valves of the Stick Pusher system. The signals from both Stall Warning systems arm the respective Stall Ident warning horn circuits.

If an approach to the stall is continued after operation of the stick shaker system, further rotation of the forward pair of incidence sensors beyond an angle varied by the rate of change of incidence completes circuits via two independent systems to both warning horns which have been armed by the associated stall warning systems. When the horn circuits are completed, both horns sound, and relay units complete a circuit to two pneumatic valves connected in series; when both valves open, low pressure nitrogen is released into the stick pusher ram. A nose-down initial force of 100lb is exerted on the control columns via the base of the Captains control column, falling sharply as the control columns are moved forward of the elevator neutral position to 23lb, and to 5lb

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at the fully forward position.

As the aircraft returns to normal flight, the warnings are cancelled, the control valves released to exhaust ram pressure.

The systems are isolated on the ground, by weight-operated Landing Gear switches, and for five seconds after take-off by a timing relay. The test switches will function only when the aircraft is on the ground.

PITOT HEATER SWITCHES (5), on roof panel. Prime function - see Chapter 11, Ice & Rain Protection.

Two switches marked 'Q' additionally control electrical heating elements in the fwd pair of incidence sensors on the fwd fuselage sides, two marked 'Port' and 'Stbd' controlling elements in the rear pair of sensors;

HEATER FAIL WARNING LAMPS (4), amber, on roof panel, one for each incidence sensor element. On when the associated heating element circuit is broken.

IGNITER ON INDICATOR LAMPS (4), on roof panel. Prime function - see Chapter 4, Engines. Illumination of the lamps during the approach to the stall signals the operation of the auto ignition system.

AUTO-IGNITION TEST SWITCH (1), on roof panel. Spring-loaded to centre 'Off' position. When pressed up, 'No.1', high energy igniters are energised via No.1 Auto-Ignition system; when held down, 'No.2', No.2 Auto-Ignition system energises the igniters. The Igniter On indicator lamps show system operation.

STALL WARNING TEST SWITCH (1), on roof panel. Spring-loaded to centre 'Off' position. When pressed up, 'No.1', No.1 Stick Shaker system operates; when pressed down, 'No.2', No.2 Stick Shaker system operates.

STICK PUSH OP LAMPS (2), amber, one on each main instrument panel. On when the stick pusher ram is pneumatically extended, goes out as the ram is returned to the fully retracted position.

STICK PUSH PRESSURE GAUGE (1), on stbd console. Dual scales and pointers, L/H scale graduated 0-80 psi with green sector from 50-66 psi, R/H scale

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graduated 0-2,000 psi with red sector from 0-500 psi.

Indicates pressure of nitrogen in the stick pusher system storage cylinder and reservoir. Dry nitrogen is stored in the cylinder (750 litres) at 1,500 psi, sufficient for approx 250 operations of the stick pusher ram; this pressure is reduced to 57psi to charge the LP reservoir. The HP system incorporates a pressure relief valve and re-charging connection.

STALL REC DUMP VALVE HANDLE (1), on centre pedestal. Turn and pull out fully to dump LP ram pressure to cabin, isolate the system control valves electrically, cancel the Stick Push Fail warning lamps on the port and stbd instrument panels. The System Fail lamp on the roof panel is switched on. Cannot be reset in flight.

LP WARN LAMP (1), red, on roof panel. On when stick pusher system LP reservoir pressure falls to 45 psi. Connected to red Pusher Fail warning lamps.

SYSTEM FAIL WARNING LAMP (1), red, on roof panel. On when any fault is detected in the Stick Pusher system; warning is duplicated by individual Pusher Fail warning lamps

VALVE OPEN WARNING LAMPS (2), on roof panel, red. On when the associated Stick Pusher control valve opens. A valve open indication in the absence of a stick pusher triggering signal is a fault indication, bringing on the System Fail warning lamp.

PUSHER FAIL WARNING LAMPS (2), red, one on each main instrument panel. On when any system warning lamp on the roof panel comes on. Cancelled by pulling Stall Rec dump valve handle.

STICK PUSH TEST SWITCH (1), on roof panel. Spring loaded to centre 'Off' position. Isolated in flight by the Landing Gear weight switch. With the Stall Warn test switch held in the No.1 or No.2 position, pushing the switch up to the 'No.1' position or down to the 'No.2' position will operate the stick pusher system, extend the ram, and bring on the appropriate system lamps. If both test switches are held in the No.1 or No.2 positions, one warning horn will sound.

cont/...

Releasing the test switch de-energises the system, the Valve Open lamp should go out immediately, but the Stick Push Op lamps will not go out until the ram is fully retracted.

CONFIGURATION WARNINGS

WARNING HORN (1). A system of microswitches connected via an interruptor unit to the Landing Gear warning horn produces an intermittent aural warning if, with the aircraft on the ground, either throttle is opened beyond about half way and:

a) The tailplane incidence is outside the take-off range, or

b) Speed brakes are not selected In, or

c) The flaps are not selected to a Take-Off position or.

d) Elevator trim tab is not within +/-1° of neutral or.

(500 excl 510 only)
e) Flaps have not reached the selected position

Should a warning be signalled with the throttles above 95%/12000 HP RPM the horn will not sound

(500 excl 510) In flight the horn will sound if:

a) the flaps and spoilers are selected coincidentally or,

b) spoilers are selected with the throttles above approx 79%

MACH TRIM SYSTEM

GENERAL DESCRIPTION. The mach trim controller is supplied with pitot/static pressure to provide altitude and mach no. information. Command signals are generated by the controller and passed to the mach trim actuator: below 9,600 +/-600 ft and below MIND 0.68 this output is blocked. Provided the altitude is above 9,600 ft approx. an increase of speed above MIND 0.68 will cause the controller to transmit a 'nose-up' signal

cont/...

to the mach trim servo-actuator connected to the tailplane trim circuit via the auto-trim servo unit. Movement of the mach trim actuator is transmitted to the tailplane trim system via an electro-magnetic clutch; this clutch can only be engaged when the auto-pilot is disengaged.

With mach trim engaged, any manual movement of either tailplane trim wheel will result in disengagement of the mach trim actuator clutch by operation of torque switches incorporated in the trim wheels.

MACH TRIM INDICATOR LAMP (1), amber, on centre instrument panel. (Port instrument panel on the 400.) On, pulsing when AC power is supplied to the actuator; with the clutch engaged or disengaged.

MACH TRIM ISOLATION SWITCH (1) on centre console. Two positions, fwd 'On', aft 'Off'. Normally selected 'On' completing AC power supply circuit to the Mach Trim controller; when selected 'Off' breaks the AC circuit to the controller, de-energising the mach trim actuator and disengaging its clutch.

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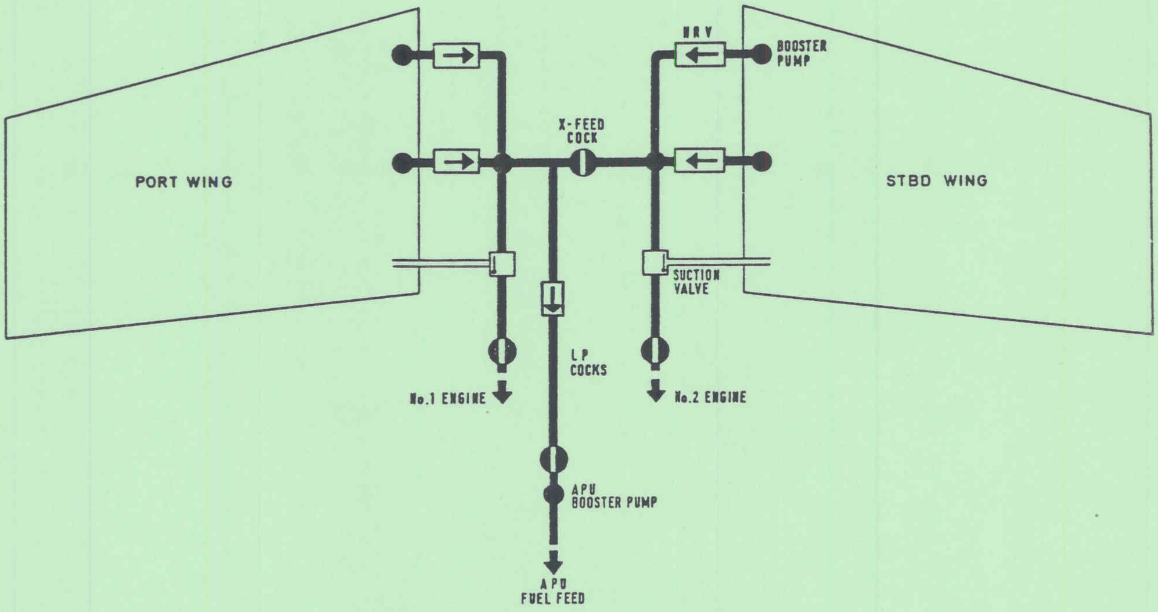
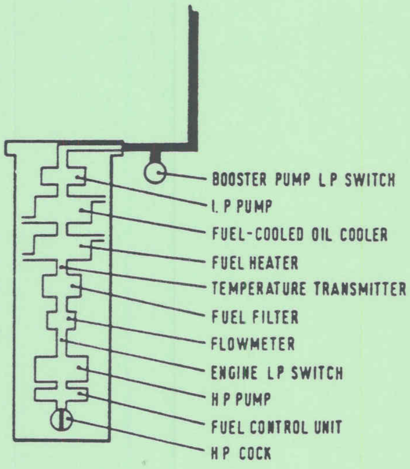
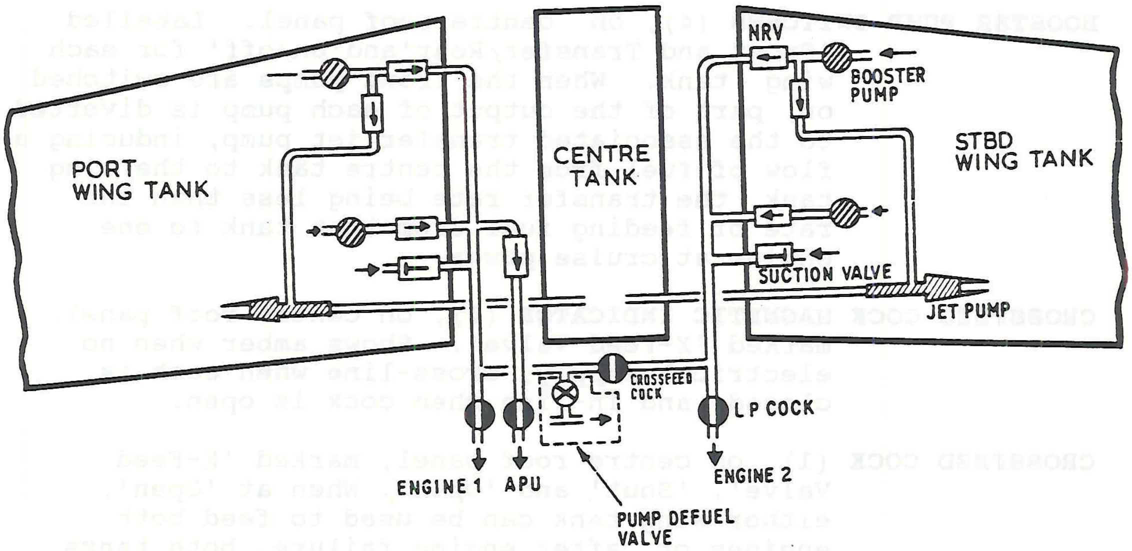
DIFFERENCES

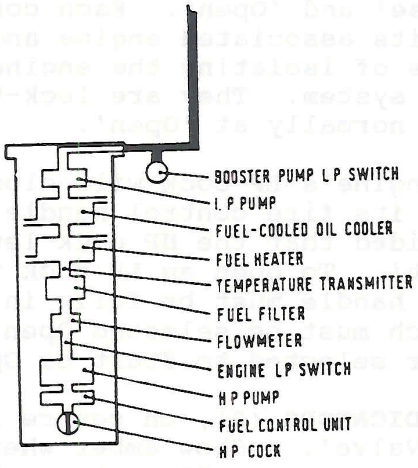
FUEL SYSTEM (510 & 400)





FUEL SYSTEM


NRV
BOOSTER PUMP
PORT WING TANK
CENTRE TANK
STBD WING TANK
SUCTION VALVE
JET PUMP
CROSSFEED COCK
L P COCK
ENGINE 1
APU
ENGINE 2
PUMP DEFUEL VALVE


BOOSTER PUMP L P SWITCH
L P PUMP
FUEL-COOLED OIL COOLER
FUEL HEATER
TEMPERATURE TRANSMITTER
FUEL FILTER
FLOWMETER
ENGINE L P SWITCH
H P PUMP
FUEL CONTROL UNIT
H P COCK

FUEL SYSTEM

FUEL QUANTITY GAUGES (3), one for each tank, on centre instrument panel. Calibrated in kg to show amount of usable fuel in tanks. Beneath each gauge is a test button; when pressed, the needle should move anti-clockwise to below the Empty mark, returning to its original position when the button is released.

BOOSTER PUMP SWITCHES (4), on centre roof panel. Labelled 'Front and Transfer/Rear'and'on/off' for each wing tank. When the front pumps are switched on, part of the output of each pump is diverted to the associated transfer jet pump, inducing a flow of fuel from the centre tank to the wing tank, the transfer rate being less than the rate of feeding fuel from that tank to one engine at cruise power.

CROSSFEED COCK MAGNETIC INDICATOR (1), on centre roof panel, marked 'X-Feed Valve'. Shows amber when no electrical supply, cross-line when cock is closed, and in-line when cock is open.

CROSSFEED COCK (1), on centre roof panel, marked 'X-Feed Valve', 'Shut' and 'Open'. When at 'Open', either wing tank can be used to feed both engines or, after engine failure, both tanks can feed the remaining engine.

LP COCK SWITCHES (2), on centre roof panel, marked 'LP Valve'. 'Close' and 'Open'. Each controls the LP cock for its associated engine and provides the means of isolating the engine from the aircraft fuel system. They are lock-toggle switches and are normally at 'Open'.

An engine's LP cock will close automatically when its fire control handle is pulled, provided that the HP cock lever has been set to 'Shut'. To open an LP cock the appropriate fire handle must be fully in, the LP cock switch must be selected Open, and the HP cock lever selected to Start or Open.

LP COCK MAGNETIC INDICATORS (2), on centre roof panel, marked 'LP Valve'. Show amber when there is no 28V supply, or when HP cock is shut while LP cock is Open. (will show cross-line when LP cock is subsequently shut). When HP cock levers are at 'Start' or 'Open', indicators show cross-line if LP cocks are closed and in-line if they are open.

400/510 DIFFERENCES

FUEL SYSTEM

On the above aircraft the **BOOSTER PUMPS** have no transfer function and are marked on/off and front/rear. Instead there is a seperate transfer function as follows:-

TRANSFER PUMP SWITCHES (2) on centre roof panel, marked on/off. Control the transfer pumps in the centre tank.

TRANSFER LP WARNING LAMP (1) amber, on centre roof panel. If the fuel pressure in thre transfer line falls with either transfer pump switched on, the lamp will come on, the refuel/defuel valves will close and the MI's show cross-line.

(510 only) (Connected to the amber MWS)

TRANSFER COCK SWITCHES (2) on centre roof panel, marked 'Trans Valve'. When selected on with the transfer line pressurised and the LP warning out the associated refuel/defuel valve will open for fuel transfer from the centre tank. Float switches will automatically close the valve if the wing tank becomes full before transfer is complete. The system is inoperative when the refuel master switch on the external refuelling panel is on.

TRANSFER COCK MI's (2) on centre roof panel. Show amber for power off or if the refuel master switch is on. Otherwise in-line or cross-line according to valve position.

BOOSTER PUMP LP WARNING LAMPS (2), red, on centre roof panel. Each lamp is controlled by a pressure switch in the pipe line at the nacelle, and gives warning of low booster pump pressure. Connected to the red master warning system via a 3-7 second delay circuit.

(400 Only) (On 400 series aircraft AVGP AWBL BBMG the LP pressure switch is downstream of the LP cock. Therefore the Booster Pump LP lamps will not extinguish with the pumps running if the LP cock is closed)

ENGINE LP WARNING LAMPS (2), amber, on centre roof panel. Give warning of low pressure in the engine fuel system immediately down-stream of the flowmeter.
(510 Only) (connected to amber MWS)

FUEL TEMP GAUGE (1), on centre instrument panel. Dual indicator, calibrated -60°C to +120°C for each engine. Indicates the temperature detected by a transmitter at the fuel heater outlet. Fuel from the backing pumps passes to the heater through the fuel-cooled oil cooler; the fuel heater uses HP compressor delivery air as necessary to further raise the fuel temperature above +5°C, to prevent the formation of ice. Control of the heater is automatic, and heating is terminated when fuel temperature reaches 25°C.

FUEL FLOW INDICATORS (2), on centre instrument panel. Show the rate of fuel flow through each engine in kg/hr. An internal by-pass valve in the flowmeter transmitter ensures a free fuel flow at all times.

HP COCK LEVERS (2), on control pedestal, marked 'HP Fuel'. Up 'Open', centre 'Start', down 'Shut'. Spring-loaded knob on each lever must be pulled to free plunger on lever from detent on quadrant before lever can be moved. Cocks control the passage of fuel from the flow regulator unit to the combustion spray nozzles. When at 'Shut' each lever also operates micro-switches, preventing the LP cock from opening, and causing the CSDS air shut-off valve to close; when at 'Open', the electrical supply to the 'open' coil of the shut-off valve is maintained. The 'Start' position allows a greater flow of fuel than does the 'Open'

cont/...

position, thus facilitating starting. The lever will be locked in the open position and the HP cock will close if the associated engine's LP compressor shaft should fail. A red lamp in the head of each lever will light to indicate:-

1. Engine fire warning.
2. Engine overheat warning.
3. Engine oil low pressure warning.

When the lever is set to Shut, the lamp will go out.

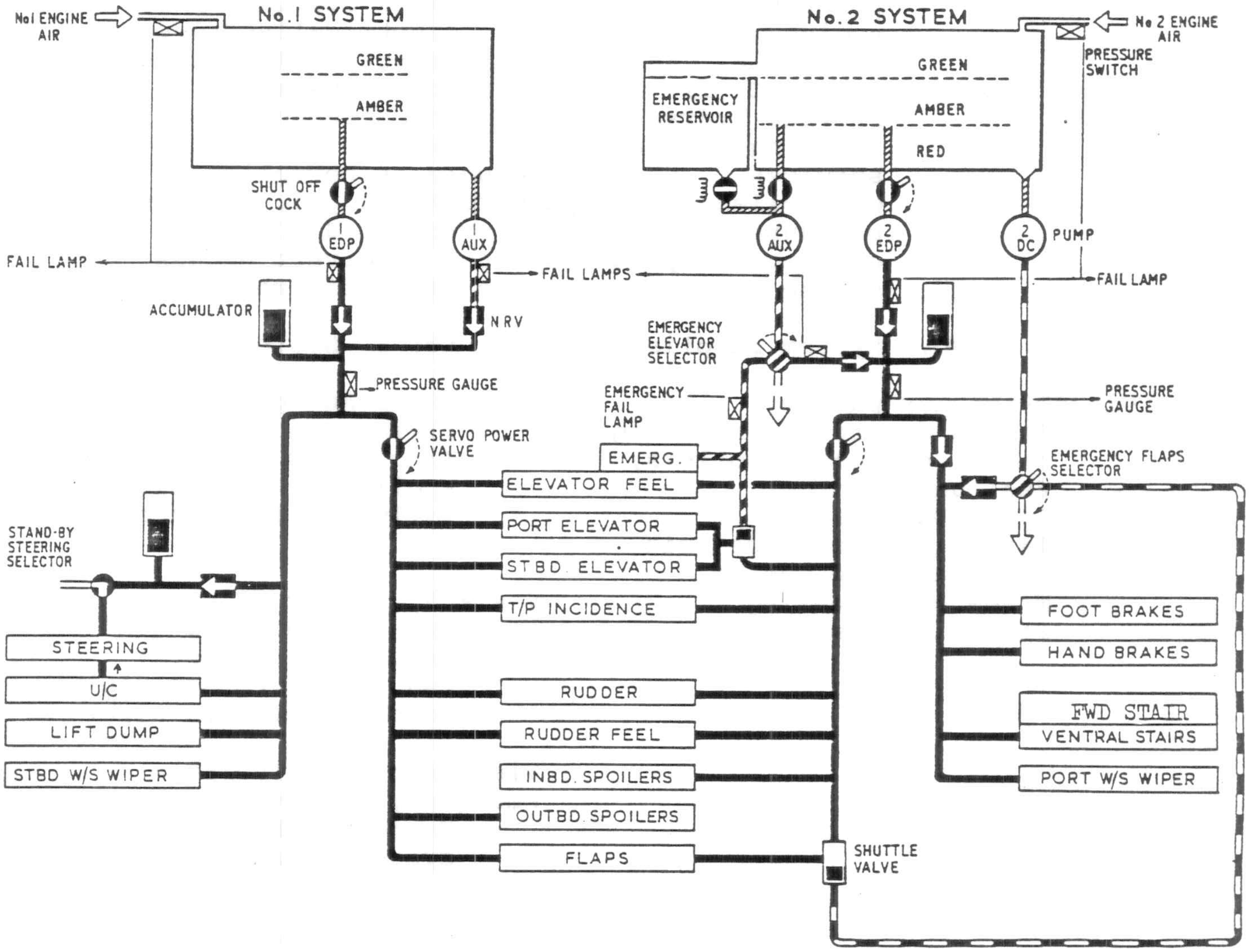
(500 excl.510) (If the HP cock is moved to Start or Open, with an engine starting air pressure at the CSD inlet of less than 15psi, the air Start Cut-off valve will close and the overheat lamp for that engine will come on.)

APU CONTROL SWITCH (1), on centre roof panel. Marked 'Off' and 'On'. When set to 'On' the APU LP cock opens. The cock will close when:

1. The control switch is set to off.
2. The APU fire control handle is pulled.
3. The fire shutdown switch on the external control panel is set to 'Fire'.
4. The APU automatic extinguishing circuit operates.

APU LP COCK MAGNETIC INDICATOR (1), on centre roof panel, marked 'Fuel Valve'. Shows cross-hatch when no electrical supply, or 'Open' or 'Closed' according to the position of the cock.

HYDRAULIC POWER SYSTEM



HYDRAULIC POWER

SYSTEM PRESSURE GAUGE (1), on hydraulic control panel. Dual instrument, indicating the hydraulic pressure in each system, left pointer - No. 1 System, right pointer - No. 2 System; the two systems are independent, and hydraulic pressure is generated by either a variable displacement engine-driven pump or an electrically-driven (AC) pump. An additional electrically-driven pump (DC) is located in No. 2 System to provide hydraulic power for emergency flap lowering or the ground operation of certain services. System pressure is normally controlled by the pump to 3,000 psi, and system pressure relief valves crack at 3,500 psi, opening fully at 3,800 psi to divert excess system pressure into the reservoir return line.

No.1 System supplies

Via EDP or Aux pump:-
- Flying Controls (including flaps, outboard spoilers, feel units)
- Lift Dumpers
- Tailplane Incidence unit
- Undercarriage system
- Nosewheel Steering
- Stbd Windscreen Wiper

No. 2 System supplies:

Via EDP or Aux pump:-
- Flying Controls (including flaps, inboard spoilers, feel units)
- Tailplane Incidence unit

Via EDP, Aux or DC pump:-
- Brakes, Foot and Hand
- Ventral airsteps,
- Fwd airstair (not 510),
- Port Windscreen wiper

Via Aux pump only, from emergency reservoir:-
- Emergency Elevator system, including Feel

Via DC pump only, from system reservoir:-
- Emergency Flap system

With all the pumps inoperative, stored system pressure will fall rapidly, through dissipation into the reservoir return lines from the individual system components.

SYSTEM QUANTITY GAUGE (1), on hydraulic control panel. Dual instrument, indicating reservoir fluid levels,

cont/...

left pointer No. 1 System reservoir, right pointer No. 2 System reservoir. The scales are divided into three sectors:

Green:	Normal Flight range
Amber:	Entered as fluid level falls due to systems operation or loss of fluid.
Red:	No. 1 system - outlet to EDP uncovered, Aux pump only available. No. 2 system - outlets from main reservoir to EDP and Aux pump uncovered, remaining contents available only to DC pump. The Aux pump can still draw fluid from the emergency reservoir to power the emergency elevator system

No. 2 System reservoir is connected to the emergency reservoir. As the fluid falls to the amber range, the connection to the emergency reservoir is uncovered, and the fluid in that reservoir is available only for the Aux pump when supplying the emergency elevator system.

The reservoirs are pressurised by engine bleed air at 38 psi to provide a pressure head at the EDPs.
Each reservoir, excluding the additional capacity and emergency reservoirs, is provided with a sight glass.

OVERHEAT WARN LAMPS (4), amber, on hydraulic control panel. The outer pair of lamps are connected to thermostats in the hydraulic reservoirs. A lamp comes on when the fluid in the associated system reservoir rises to 85-95°C, remaining on until the temperature falls below this range. LH lamp connected to No.1 System reservoir. RH lamp to No.2 System. If either lamp comes on, the associated EDP and Aux pump should be switched off - the Aux pump can be switched on if the lamp subsequently goes out.
The inner pair of lamps are connected to thermostats mounted on the casings of the Aux pump motors. A lamp comes on when the thermostat on the associated pump detects a significant temperature rise. LH lamp

cont/...

connected to No.1 System Aux pump thermostat, RH lamp to No.2 System. Either lamp remains on until the pump casing temperature falls. If either lamp comes on, the associated Aux pump should be switched off; and thereafter used in emergency only. When the Aux pump switch is selected 'Off', the warning lamp is cancelled.

(510 only) (all 4 lamps are connected to the amber MWS)

AUX PUMP SWITCHES (2), on hydraulic control panel, up 'On', down 'Off'. When either switch is selected 'On', the associated Aux pump is energised to provide main system pressure controlled to 3,000 psi. Either pump can draw fluid from its associated reservoir by pump suction, in the event of loss of reservoir air pressure: the No.1 system pump via a sump at the bottom, No.2 system pump via a stackpipe in the reservoir (to maintain an emergency reserve for flap lowering by the DC pump) or from the emergency reservoir. Gate valves in the supply lines to No. 2 Aux pump control the pump supply and are operated by the No. 2 Aux pump switch and the emergency elevator selector.

With the pump switch selected On, and the Elevator Emerg selector 'Off', the supply is from the system reservoir and the line from the Emergency reservoir shut off; when the Elevator Emerg selector is selected 'Emergency', the valve positions are reversed, the supply from the system reservoir shut off, and the pump supplied from the emergency reservoirs.

ENGINE PUMP SWITCHES (2), on hydraulic control panel, up 'On', down 'Off' (centre 'off' on 539). When either switch is selected 'Off', the associated engine-driven pump off-load solenoid is energised, and the EDP maintains an off-stroke condition in which a low flow of fluid is allowed through the pump to the reservoir return line at 300 psi to provide pump lubrication and cooling.

When either switch is selected 'On', the associated EDP off-load solenoid is de-energised, and the EDP reverts to automatic operation to generate system pressure and control it to a nominal 3,000psi, off and on-stroking to maintain that pressure against systems operation and normal system leakage.

cont/...

(539 Only) (There are three switch positions, up-'On', centre-'Off' and down-'Isolate'. At isolate an electrically actuated gate valve is closed, cutting off the supply of hydraulic fluid to the EDP. With the switch at isolate and the engine running, the drive to the pump will eventually shear due to the increasing internal friction caused by dry running.)

PRESSURE FAIL WARN LAMPS (4), amber, on hydraulic control panel. Connected to pressure switches on the delivery line from each EDP and Aux pump. Left outer No.1 EDP, left inner No.1 Aux pump, right inner No.2 Aux pump, right outer No.2 EDP. On when the associated pump delivery pressure falls to or below 1,500 psi.

The outer lamps are also connected to pressure switches in the pressurising air supply lines to the system reservoirs, and come on if the air pressure falls to or below 8 psi. The outer lamps go out as the hydraulic pressure rises above 1,500psi and the reservoir air pressure rises above 8 psi.

The inner lamps will go out when the hydraulic pressure exceeds 1,500psi, irrespective of the reservoir air pressure. Each inner lamp is isolated when the associated Aux pump switch is selected Off.
(510 only) (All 4 lamps are connected to the amber MWS)

DC PUMP SWITCH (1), on hydraulic control panel. Centre 'Off', up 'Brake Acc', down 'Emerg Flap'; spring biased 'Brake Acc' to 'Off'. When selected 'Brake Acc', the DC pump is energised to charge the brake accumulators and provide hydraulic power for the port windscreen wiper and the airstair systems; an electrical circuit is also completed to the brake accumulator pressure gauge, and the flap emergency selector valve is de-energised.

When selected 'Flap Emerg', the DC pump is energised and the flap emergency selector valve diverts pump output into the No.2 flap motor of the flap drive unit via a shuttle valve - see Flight Controls.

With the switch selected 'Off', the DC pump is energised when the No.2 system pressure is less than 1,500 psi and the airstair controls are operated.

POWER VALVE MI's	See Flight Controls section
SPOILER FAIL WARN LAMPS	"
OUTER SPOILER SWITCH	"
INNER SPOILER SWITCH	"
GUST DAMPER ENGAGED LAMP	"
FEEL FAIL WARN LAMP	"

ICE AND RAIN PROTECTION SYSTEMS

ICE DETECTION

ICE WARN LAMP (1), red, on centre roof panel. Connected to the red master warning system. Comes on when ice forms on the rotating detector on the port side of the nose, goes out when ice formation ceases, provided that both engine anticing switches are at 'On'; if both engine anticing switches are not 'On', the lamp will remain on when ice formation ceases. Oleo-controlled relays prevent the detector from operating when the aircraft is on the ground.

ICE INDICATOR SWITCH (1), on centre roof panel, with positions 'Light', 'Off', 'Heat', spring-loaded from 'Heat' to 'Off'. When at 'Light', illuminates the visual ice indicator rod outside the Captain's DV window to permit inspection for ice accretion at night. When at 'Heat', the rod is heated to disperse the ice and is also illuminated.

ICE INSPECTION LIGHT SWITCH (1), on centre roof panel. Marked 'On', 'Off'. Controls lamps in the fuselage sides ahead of the wing and in the wing trailing edge fillets which illuminate the wing leading edges and engine intakes respectively.

ICE DETECTOR TEST SWITCH (1), under the 'Intercom' panel near the ice detector, spring-loaded to off. When held to 'Test' enables operation of detector and ice warning lamp to be checked on the ground by over-riding the oleo-controlled relays.

AIRFRAME ANTICING

WING ANTICE SWITCHES(2),
TAIL ANTICE SWITCHES(2) on centre roof panel. One of each for each anticing system. Three positions, 'Test', 'Off', 'On', spring-loaded from 'Test' to 'Off'. When set to 'On' the appropriate shut-off valve is opened (provided there is air pressure in the ducts and the weight is off the undercarriage) to connect the related air supply system to the wing or tail anticing system.

cont/...

When set to 'Test' the undercarriage cut-out is overridden and the shut-off valves open, allowing hot air to flow past the temperature sensors in the ducts, giving a change in the reading of the temperature gauge.

Either system can supply the whole of the wing and tail anticing if required.

WING, TAIL TEMPERATURE GAUGE (1), on centre roof panel. A dual gauge, calibrated 0-300oC, with red, green, red sectors. Pointers are actuated by sensors in the anticing air supply ducts. (Some 400 aircraft have a switch to allow this gauge to display mains temperature instead)
(400/510 only)

WING, TAIL AIR SUPPLY MI's (2), on centre roof panel. One for each anticing system, displaying 'Off' when the associated system is switched off or there is no pressure available, and 'On' when the air pressure in the common duct downstream of the Non-Return valves reaches a satisfactory value.
(500 excl 510)

MAINS TEMPERATURE GAUGE (1), on centre roof panel. A dual gauge, calibrated 0-300oC, with red, green, red sectors. Indicates the temperature of each main air system downstream of the primary heat exchangers.
(Not 400)

ENGINE AND INTAKE ANTICING

ENGINE ANTICE SWITCHES (2), one for each engine, on centre roof panel. Marked 'On' and 'Off'. When a switch is set to 'On' duplicated air control valves open to allow high pressure engine bleed air into the system, and thereafter regulate its pressure. The air circulates through the intake guide vanes and inlet hub fairing, then through the nose cowling, and exhausts to atmosphere through outlets above the leading edge of the nacelle fairing.

ENGINE AIR PRESSURE GAUGES (2), on centre roof panel, one for each engine. Indicate the pressure downstream of each pair of air control valves. The purpose of the engine air pressure gauge is to serve as an indication that anticing air pressure is available and that the regulating valve is open. If at any time there is doubt that an engine anticing regulating valve is operating, this can be checked by opening the throttle

cont/...

which will increase the engine anticing pressure reading to between approximately 45 - 57 psi; after reaching its maximum, the pressure may start to fall off as higher engine speeds are used - this is particularly true at low altitudes.

(500 excl 510) (During each engine start cycle the gauge for that engine will show the air pressure in the duct to the air motor, from the time the start/relight switch is pressed till the engine start relay is automatically released or the start master switch is selected off.)

PITOT PROTECTION

PITOT HEATER AMMETERS (5), on left hand and centre roof panels. Marked from left to right, 'Lower Stbd - DC amps', 'Q - AC amps', 'Q - AC amps' 'Port - DC amps', 'Stbd - DC amps'.

Each ammeter gives an indication of satisfactory operation of the pitot head heater element controlled by the associated switch.

PITOT HEATERS SWITCHES (5), on left hand and centre roof panels, adjacent to their associated ammeters. Positions 'On' and off. Control heater elements as follows;

'Lower Stbd' switch	-	Lower starboard pitot head.
'Q' switch (left)	-	Port Q feel pitot head and port stall recognition sensor.
'Q' switch (right)	-	Starboard Q feel pitot head and starboard stall recognition sensor.
'Port' switch	-	Port pitot head and port stall warning sensor.
'Stbd' switch	-	Starboard upper pitot head, starboard stall warning sensor.

HEATER FAIL WARNING LAMPS (4), amber, on left-hand roof panel. Marked 'Warn - 1, 2', and 'Rec - 1, 2'. A lamp illuminates in the event of failure of the

cont/...

heater element in its associated stall warning or stall recognition sensor, and also when the heater is not switched on.

WINDSCREEN PROTECTION

WINDSCREEN HEATING SWITCH (1), on centre roof panel. Marked 'High', 'Off' and 'Low' ('Normal' on 510). Controls the electrical supplies to transparent gold film heating elements between the laminations of the two windscreen panels. When at 'Low' (or 'Normal') the panels are heated sufficiently for normal anticing and demisting purposes and to improve resistance to bird impact. When at 'High' a greater degree of heating is provided for severe icing conditions. The temperature of each windscreen panel is thermostatically controlled within a working range.

WINDSCREEN O/HEAT WARNING LAMPS (2), amber, on centre roof panel. If the thermostatic control of either windscreen panel should fail, an overheat sensing element will cause the heating supply to be cut off and the overheat warning lamp to come on. When the temperature falls to the upper end of the working range the supply will be restored and the warning lamp will go out.
(510 only) (Connected to the amber MWS)

WINDSCREEN U/HEAT WARNING LAMPS (2), amber, on centre roof panel. A lamp will come on when the temperature of its associated windscreen panel falls to a pre-determined value, and will go out when the temperature rises to the lower end of the working range.
(510 only) (Connected to the amber MWS).

SIDE WINDOW HEATING SWITCH (1), on centre roof panel. Positions 'On' and off. Controls the electrical supplies to the gold films of the DV and side windows to provide heating sufficient for de-misting. The supplies to the DV windows are further controlled by micro switches and sliding contacts, so that these windows are heated only when closed and locked. The temperature of the windows is thermostatically controlled within the same working range as the windscreen panels, there being a controller for each side and overheat cut-outs which operate in the event of controller failure.

WINDSCREEN WIPERS CONTROLS (2), on control pedestal. Rotary controls marked 'Off', 'S', 'F'. Each controls the supply of fluid to the hydraulic motor which operates the associated wiper arm, giving infinitely variable control of wiper speed. The port wiper is supplied by No.2 hydraulic system, and the starboard wiper by No.1 system. When a control is set to 'Off', the wiper arm parks automatically at the bottom of thewindscreen.

RAIN REPELLENT SELECTOR (1), on port console. Three-position cock, left '1', centre 'Off', right '2'. Selects the container from which the supply is drawn. The Rain Repellent system is inoperative.
(510 only)

RAIN REPELLENT SWITCHES (2), on control pedestal, marked 'Up to operate', spring-loaded down. The Rain Repellent system is inoperative.
(510 only)

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LANDING GEAR RETRACTION/LOWERING

GEAR SELECTOR LEVER (1)
LATCH RELEASE KNOB (1)
LOCK OVERRIDE LEVER (1). On centre instrument panel. The selector lever moves vertically in a gated quadrant, 'Up' and 'Down', and is held in the selected position by a spring-loaded latch; to make a selection, the latch is disengaged by pulling the black release knob forming the head of the selector lever.

Lever movement is transmitted by cables to the gear control valve. With the main gear legs compressed by the weight of the aircraft, the selector lever is locked in the Down position by a safety lever operated by a lock solenoid: the solenoid is de-energised, allowing a roller on the selector lever shaft to engage on a detent on the safety lever. A microswitch in the circuit to the Gear Unlocked warning lamp is operated by the latch to give warning of an un-latched condition.

The main gear legs retract inward, the nose gear forward: the unpressurised wheel bays are sealed by mechanically linked (nose and outer main bays) or hydraulically operated (main inner bay) doors, and additional small, fixed doors are mounted on the main gear legs. The main bay doors and the two forward nose bay doors are closed when the gear is selected and locked Up, or down, being opened during the raising and lowering only. No.1 System pressure is used for gear raising and lowering.

The nosewheels are self-centring, a centring valve ensuring that raise line pressure cannot be relayed to the nose gear lock and retraction jacks unless the nosewheels are centred. During retraction, the nosewheels engage guide and spin brake ramps to maintain the centred condition and stop wheel rotation. The nose gear is geometrically locked up or down by a hydraulic lock jack. Rudder Fine steering is disconnected by nosewheel oleo extension during rotation, and normal steering system depressurised by gear Up selection

At the commencement of retraction, the main wheel brakes are applied by Hand brake system pressure from the 'Raise' line operating the auto-brake

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system; when retraction is complete, the main gear legs are held up by locked hydraulic fluid. As each main leg extends fully during lowering, the spring-loaded Down lock is mechanically engaged. With the gear fully locked up, the landing gear operating system is opened to No.1 System return lines, and maintained in the de-pressurised condition as long as the selector lever is left in the Up position.

If the landing gear lock solenoid is not energised when the aircraft becomes airborne, and the safety lever detent remains in engagement with the selector lever roller, the selector lever can be released manually by pressing down the lock-override lever mounted immediately below the selector lever arm.

FREE FALL LEVER (1), below a hinged cover on flight deck floor, adjacent to stbd console. Raise cover, pull lever up and lock in the operated condition to lower the gear in the event of normal operating system or No.1 Hydraulic System failure.

Regardless of the setting of the control valve, the pressure supply to that valve is shut-off, and both the 'raise' and the 'lower' lines opened to reservoir return. The Relay and Lock valve is opened to release trapped hydraulic fluid in the line to each retraction jack. The nose gear lock and the main gear bay door locks are released.

Each landing gear leg falls under its own weight, opening the bay doors by direct contact or the operating linkage as appropriate.The spring-loaded nose gear lock and main gear down lock re-engage as each leg reaches the 'fully down' position. The main gear bay inner doors remain open.

GEAR UNLOCKED WARNING LAMP (1), red, twin-lamp unit on centre instrument panel. On when any leg is not locked in the selected position, or an inner main door is unlocked. On when the landing gear selector lever is not latched securely in either gated positon. Bezel engraved 'Gear Unsafe'.

GEAR DOWN INDICATOR LAMPS (3), green, twin-lamp units on centre instrument panel. On when the associated landing gear legs are locked down.

DIMMING SWITCH (1), on centre instrument panel immediately beneath landing gear indicator lamps. Up

cont/...

'Bright', down 'Dim'. Alters the intensity of all four indicator lamps. (On the 539 the red lamp always stays bright)

WARNING HORN (1). Sounds (continuous) when any gear leg is not locked down and either:-

(a) One or both throttle levers are closed below the approach rpm setting at an IAS of 165 kt or below. (At any speed on the 400)

Or:-

(b) The flaps are extended beyond 18/ 20°, when the warning can only be suppressed and cancelled by raising the flaps or locking all gear legs down.

In case (a) only, the horn cut-off switch allows the warning to be suppressed: the circuit is re-armed when the gear is locked down, or both throttles are opened beyond approach power.

HORN CUT OFF/TEST SWITCH (1), on centre instrument panel. Up 'Cut Off',to isolate the horn, down 'Test', to complete independent electrical circuit to the warning horn. Spring-loaded from both selections to centre 'Off'.

MAIN GEAR MECHANICAL INDICATORS (2), one on each wing upper surface. Green-painted rod extends into raised perspex cover as associated main gear leg is locked down.

NOSE GEAR MECHANICAL INDICATOR (1), sight tube under access panel in the floor at the rear of the flight deck. Two superimposed quadrants, each with a hole cut in it, are linked to the nose gear lock and retraction jacks. The hole in the upper quadrant is covered with a transparent green glass, and a reflector is mounted below the lower hole. With the wheelwell light on, and the nose gear locked down, the holes in the quadrant coincide to allow the reflected light to be seen through the sight tube and green glass; the result should be a full green disc.

NOSEWHEEL STEERING

NOSEWHEEL STEERING HANDWHEELS (2), on port and stbd consoles. Conventional steering wheels connected by cables to the input/feedback linkage of the steering control valve. The system is powered either by No.1 System pressure via the nosegear steering and lock valve or No.1 System direct via the standby steering selector. The hand wheels are interconnected, giving steering up to 70° of offset in either direction. Hydraulic pressure is only available when the nose gear is locked down.

Rudder pedal movement is fed into the steering control system via a hydraulic/mechanical interconnection. Rudder Fine steering is limited to a nosewheel deflection of 5-7° to either side, corresponding to full rudder travel. The break-out force of the inter-connection is low, enabling independent control of rudder and nosewheel steering to be easily gained. Nosewheel position indication is given by a white mark on each wheel and three white marks on the handwheel mountings.

The response of the steering system to handwheel movement is virtually instantaneous. With pressure available handwheel position coincides with nosewheel offset. When either handwheel is moved the nosewheels will be maintained at the selected deflection by hydraulic locking of the steering jacks; if the handwheel is released, the nosewheels will be steered back to centre, and the handwheel will rotate back to the central position. With the wheels and rudder bars free to move, free castoring is available within the deflection range of the rudder fine steering system, the controls moving in accordance with the nosewheels.

STANDBY STEERING SWITCH (1), on port console. Guarded, caged in the 'Off' position, hinge back cage to select 'On'. When selected on, completes a circuit from the weight switches on the main gear legs to the solenoid of the standby steering selector valve.

When the weight switches are operated, as the gear legs support the aircraft's weight, and with the standby steering switch selected 'On', No.1 System pressure is supplied via a shuttle valve to the steering control valve. In the event of No.1 System failure, fluid stored at 3,000 psi is

cont/...

available in the standby accumulator for nosewheel steering, providing steering movements totalling 180° approx.

LOW PRESS WARNING LAMP (1), amber, on port console. On when the standby steering accumulator pressure falls to 2,000 psi.

WHEEL BRAKES

ACCUMULATOR PRESSURE GAUGE (1), on centre instrument panel. Dual pointer instrument, scales calibrated 0-4,000 psi in 1,000 psi divisions; LH pointer - foot brake accumulator pressure, RH pointer - hand brake accumulator pressure. Brake system pressure is supplied by No. 2 System; in the event of failure of No. 2 System, the accumulators store sufficient pressure for:

Foot brakes - One complete braked landing, with the anti-skid units operating.

Hand brakes - Minimum of six full brake applications.

BRAKE TOE PEDALS (4), one attached to each rudder pedal. Pedal movement is transmitted by a hydraulic servo system, from the left pedal of each pair to the port brakes control valve, from the right pedals to the stbd brakes control valve, to direct pressure to the port and starboard brake units via shuttle valves up to a maximum of 3,000 psi. With the anti-skid system operating, the applied brake pressure can be automatically reduced by each dual pressure control valve, these valves also acting as pressure relief valves for the lines to the individual brake units.

ANTI-SKID SELECTOR SWITCH, (1) on centre instrument sub-panel. When selected up 'On', the anti-skid system monitors wheel deceleration rate for each main wheel. Information from a transducer within each wheel axle provides a continuous electrical signal, proportional to wheel rotation velocity, to the controller unit. As the applied brake pressure at each wheel approaches the maximum consistent with runway condition, the controller unit detects the onset of skid by the increase of the wheel deceleration rate above a pre-set limit,

cont/...

and reduces the applied brake pressure to the affected wheel by actuating one dual pressure control valve until the wheel has spun-up to a normal speed.
The Anti-skid system additionally provides:

> Locked wheel protection:- if one wheel stops turning whilst the corresponding wheel on the other gear leg is rotating, brake pressure to that wheel is completely released. This facility is cancelled below 15 kt.
>
> Brakes on at touchdown protection:- Brake pressure is isolated from the wheel brake units until weight switches on the main gear legs have operated, and the wheels have spun-up.

When selected Off, applied brake pedal pressure will direct a proportional pressure direct to the wheel brake units, without any relief in the event of a locked or skidding wheel.

ANTI-SKID TEST SWITCH (1) on centre instrument sub-panel. Spring-load to centre 'Off' position. When held up, 'Inner Test', or down 'Outer Test', applies simulated wheels rotating transducer signals from the appropriate wheels to the control unit. Switch operation during brake application would cause loss of braking for 1-2 secs.
If external confirmation of correct system operation is required, the brakes should be applied during the check.

ANTI-SKID INDICATOR LAMPS (4), engraved 'rel' (release) on bottom of centre instrument panel, one for each wheel brake unit. These illuminate when brake pressure is released by anti-skid system, or by use of the test switch.

To test the system;

1. All four indicator lamps - Check out

2. Test switch to 'Inner' - When released, inner lamps illuminate momentarily then go out.

3. Test switch to 'Outer' - When released outer lamps illuminate momentarily then go out.

4. Test switch to 'Off' - Check all lamps out

cont/...

NOTE: The above test sequences apply whether brake pressure is applied or not.

(515/523/528 and 539) (Instead of 'rel' indicators there are 4 amber lamps which otherewise fulfill the same purpose)

FOOT BRAKE PRESSURE GAUGE (1), on centre instrument panel. Dual pointer instrument, showing brake pressures applied by the port and starboard brake control valves to the respective dual control valves, scales calibrated 0-4,000 psi in 1,000 psi divisions.

HAND BRAKE LEVERS (2), one on either side of the centre console. As either lever is pulled up, the movement is transmitted by cable to the hand brake control valve, and brake pressure is directed equally to all four brake units via the shuttle valves. 'Feel' is given by springs, the applied pressure proportional to the amount of lever movement up to a maximum of 3,000 psi.

The hand brake control valve is also operated by the auto-brake jack to give a brake application of 400-600 psi during gear retraction. (1000-1600psi on the 400). Auto-brake application is indicated on the handbrake pressure gauge.

The port (Captain's) lever can be locked in the Parked position by pulling fully up and turning the handle 90°.

HAND BRAKE PRESSURE GAUGE (1), on centre instrument panel. Single pointer, scale calibrated 0-4,000 psi in 200 psi divisions.(50psi divisions on 510). Shows hand brake pressure applied to the wheel brake units.

BRAKE TEMPERATURE GAUGES (2), centre instrument sub-panel. (501/510/530 on the starboard console) Dual pointer instruments, scales graduated 0-800°C in 100° divisions. LH gauge shows port outer and inner brake unit temperatures, RH gauge stbd inner and outer temperatures.

Following a sustained brake application, eg - during landing or abandoned take-off, the gauges will under-read for approx. 3-5 minutes, after which time the temperature indications will be accurate with or without the brakes being applied.

DC PUMP SWITCH (1), on hydraulics panel. When selected 'Brake Acc', the DC pump is energised to provide

cont/...

hydraulic power for the operation of brakes, forward (not 510) and ventral air stairs and port windscreen wiper, or for emergency flap lowering; the switch is spring loaded from 'Brake Acc' to centre 'Off'. The DC pump is also energised to provide the above service when the air stair controls are operated, even if the pump switch is selected Off.

When selected 'Flap Emerg', the emergency flap selector valve is electrically actuated to shut off the line from the DC pump to the normal services above, and to direct pump pressure to the flap drive unit until the switch is manually returned to the Off position - See also 'Flight Controls' section.

SAFETY EQUIPMENT

EMERGENCY DOORS The port entrance door and the service door should be used as emergency exits as the situation demands. If circumstances permit, the rear entrance door should also be used.

EMERGENCY WINDOWS The flight deck DV windows can be used as emergency exits by opening them in the normal manner.

Escape hatches are fitted on each side of the cabin above the wing, and can be opened from inside by using the PULL handle, then lifting the hatch and removing it inwards. When removed in an emergency, the hatches are to be turned sideways and ejected out of the cabin, forward if possible, away from the escape route on the wing. Each hatch can also be opened from the outside by tearing off the two hand-hole covers, then using the PUSH button at the top of the hatch, and lifting it away.

HAND HELD CHUTES, (400/510 only) are carried in stowages in the forward vestibule roof. When a slide has been released from its stowage a PULL tab is exposed, which is attached to a pin in the centre of a telescopic bar. Removal of the pin allows the bar to extend, and it must then be engaged in the hooks at the bottom of the door surround to provide the lower anchorage for the slide. They are being progressively replaced by inflatable slides

INFLATABLE SLIDES are carried, in stowages on the forward cabin doors, which deploy and inflate automatically when the door is opened from the inside with the slide snap hook engaged in the floor fitting. The slide is inflated by compressed air from an attached cylinder, and an air pressure gauge attached to the cylinder can be seen through a circular window in the door stowage. If the door is opened from the outside, with the snap hook engaged, an auto-disconnect linkage prevents slide inflation, however the slide will still be deployed uninflated. The slides are not interchangeable, and are identified by yellow symbols on the slide pack and the stowage, a triangle for the LH slide and a circle for the RH.

△ = LH
○ = RH

(500excl 510&539) (On these aircraft there is only one inflatable slide, fitted to the starboard door)

LIFEJACKETS The lifejacket is completely self-righting and is held in position by tying its two tapes round the waist.

Initial inflation is brought about by pulling sharply the red knob on the CO_2 cylinder at the bottom of the jacket. Subsequent topping-up is done through a mouth inflation tube, equipped with a non-return valve. Inflation should be delayed until after leaving the aircraft. The jacket can be deflated by carefully inserting into the mouthpiece the plastic key which is provided. A light operates automatically with immersion of the jacket. A plastic whistle, deflation key and lanyard are also fitted.

LIFESAVING COTS Inflation of the cot should be done before ditching by a member of the cabin crew and not by the parent. If fitted, the 'Pull to Light' flap must be pulled. The cot should be lowered into water, NOT carried by someone jumping in.

BREAK-IN AREAS Four break-in areas are marked on the top of the fuselage; one over the front of the cabin, one above the wing leading edge, one above the wing trailing edge, and one over the rear end of the cabin.

MEGAPHONES Megaphones are powered by internal batteries, with an integral handle incorporating the On/Off trigger; the microphone is mounted at the rear of the body, with a volume control. The megaphone should be held with the microphone close to the mouth, and the trigger held in for the duration of the announcement. For announcements made within the aircraft cabin use the 'Low' position of the volume switch, outside the aircraft use the 'High' setting.

ESCAPE ROPES These are stowed in conduits mounted in the roof above the forward stbd door and above each flight deck side window and are withdrawn for use by using the tag marked 'Pull' on the end of each rope. The rope must be pulled out until a green band is exposed, indicating that it is fully extended, before use.

WATER EXTINGUISHER is intended for use on fires not involving electrical equipment, where the jet can be directed on the fire; the jet is electrically conductive, and if used on live electrical equipment could hazard the user and other electrical equipment; it must not be used

cont/...

on the flight deck. Water must not be used on inflammable liquids, as the jet will simply spread the liquid over a greater area and not extinguish the flames. To operate, hold the extinguisher upright, press the lever, and direct the jet as close as possible to the base of the fire - duration is approximately 15 seconds.

BCF EXTINGUISHERS smother and cool fires, by interposing a barrier of incombustible vapour between the burning substances and the free atmospheric oxygen, and are specifically intended for use on fires involving electrical equipment or inflammable liquids. Liquid BCF is non-conductive, is converted into a non-toxic vapour when heated, but in high concentrations the vapour is a lung irritant and a smoke hood must be used by the operator. To operate, aim the nozzle at the base of the fire, keeping the extinguisher within 45° of vertical, raise the safety catch, squeeze the trigger. Cover the fire area progressively, moving forward steadily with a side to side sweeping action. The duration is 15 seconds maximum, and the jet has a range of 6ft.

OXYGEN SYSTEM (refer to Air Conditioning)

TOILET SMOKE DETECTION Each toilet smoke detector is wired to a control panel located at ceiling level in the forward galley. If smoke is detected in a toilet of a 400/510/539 aircraft a red light on the outside of the toilet will flash and a red light on the galley panel will illuminate. In addition a high pitched chime will be heard.

On the other aircraft the detector triggers the cabin crew call chimes, flashes the toilet engaged light and illuminates a 'lavatory smoke' sign at the bottom of the port instrument panel.

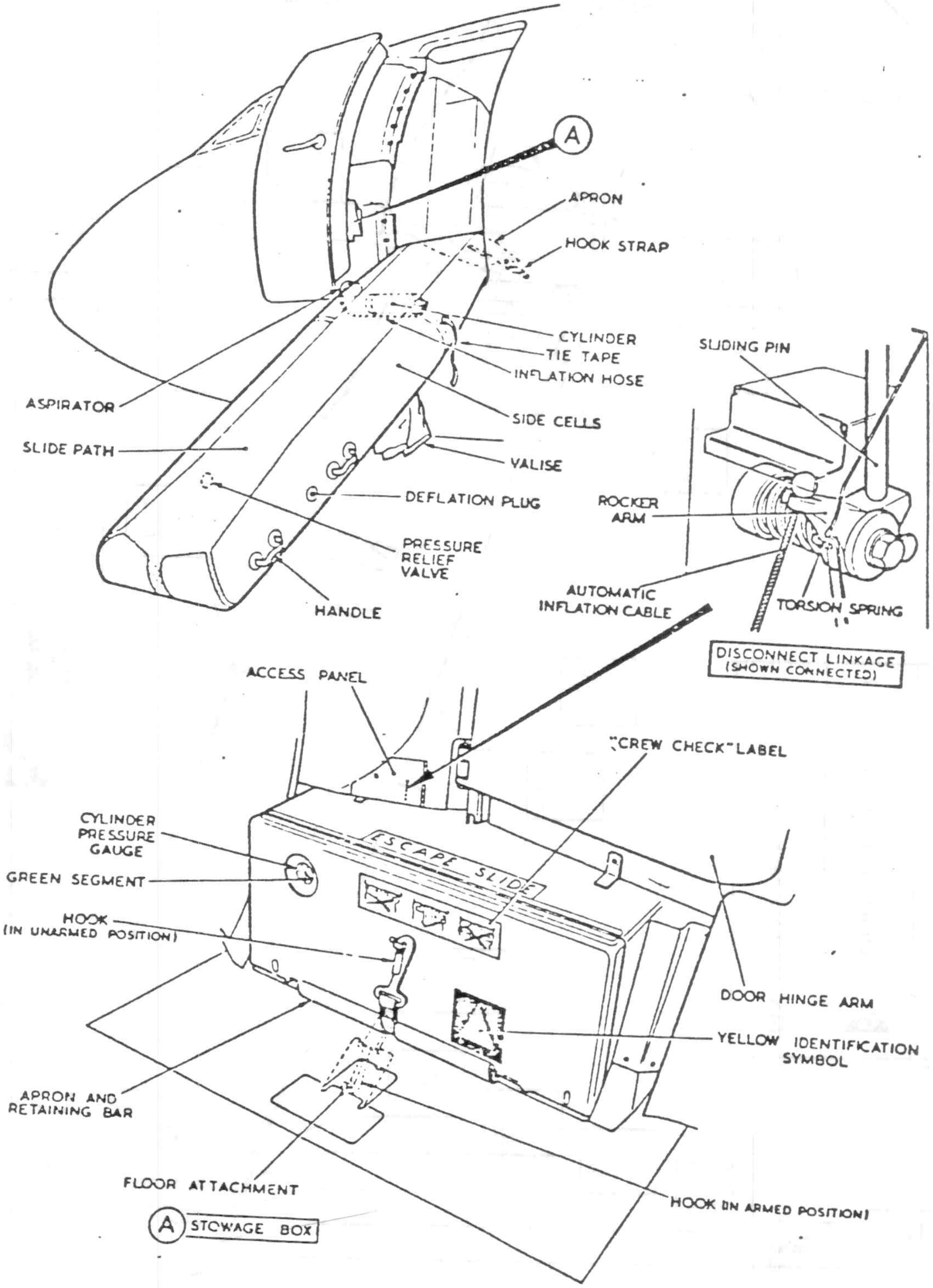
The chimes can be silenced by pressing the buttons marked 'HORN OFF' on the galley control. The other indicators can only be cancelled by pressing the 'RESET' button AFTER the smoke has cleared.

By pressing the 'TEST' button on the control panel for a few seconds, the system may be tested. The red indicator lights on the toilets will flash and also show on the appropriate

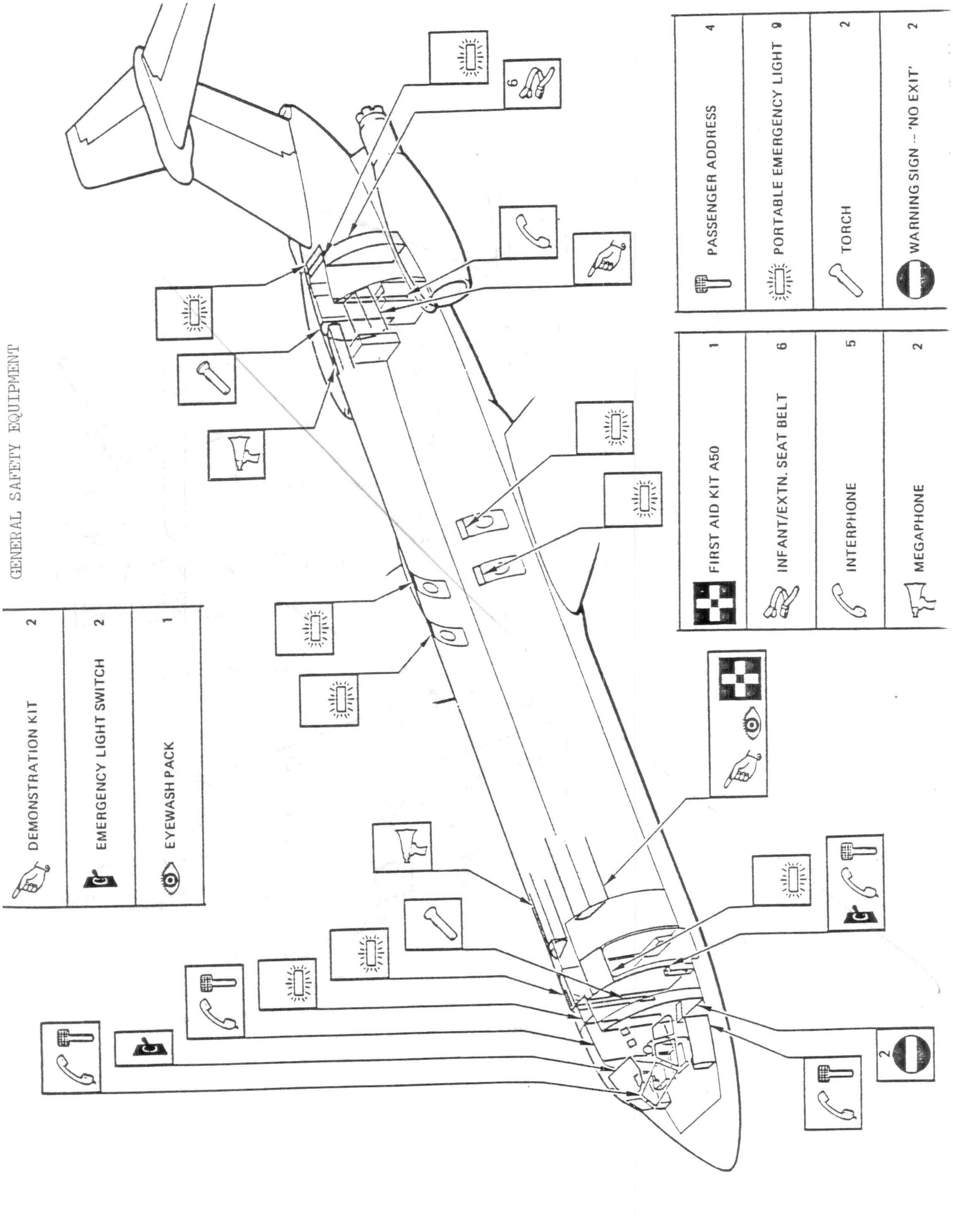
cont/...

control panel. The chimes will also sound. To cancel the HORN button should be pressed followed by the RESET button which cancels the lights.

INFLATABLE ESCAPE SLIDES



GENERAL SAFETY EQUIPMENT

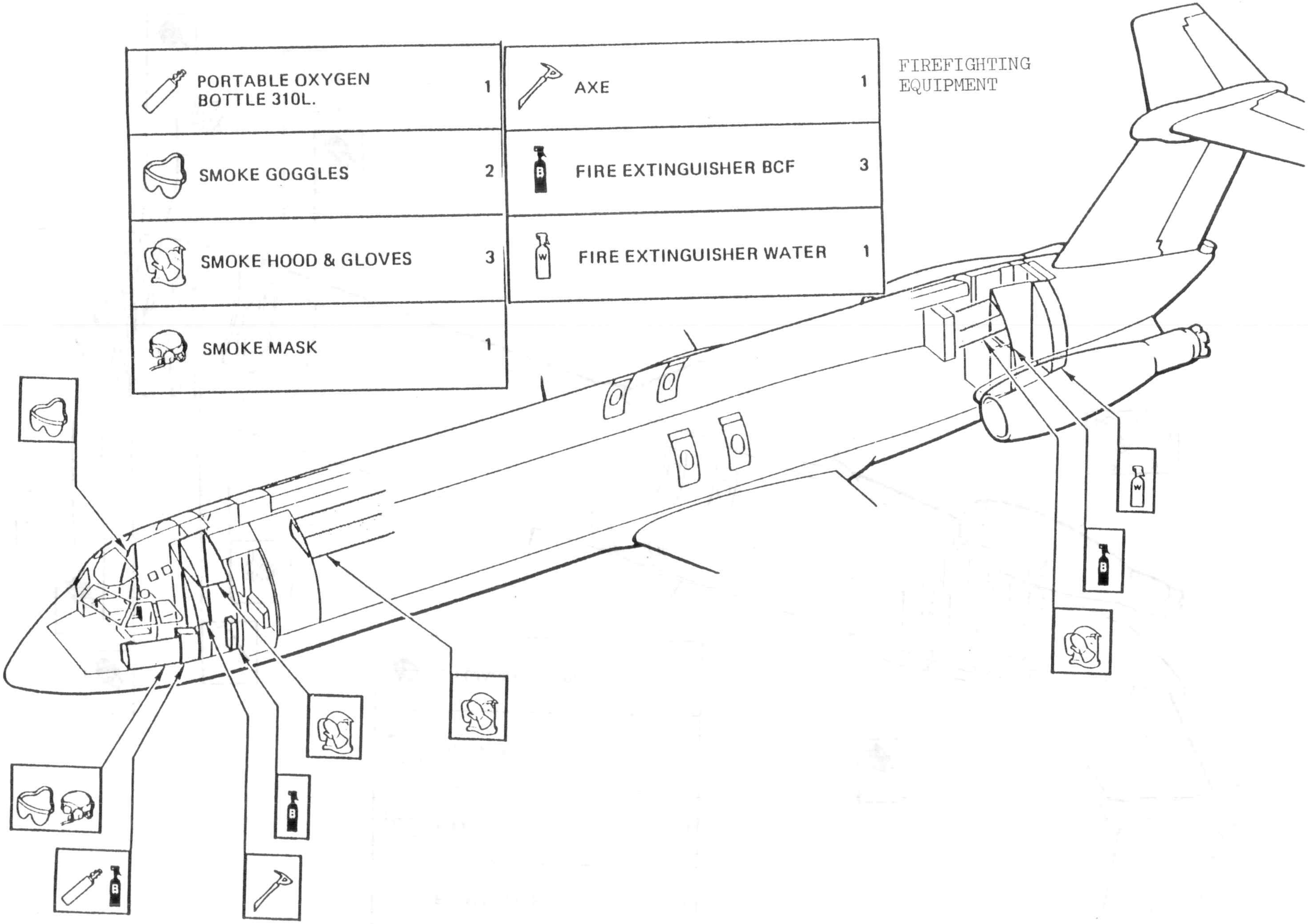


DEMONSTRATION KIT	2
EMERGENCY LIGHT SWITCH	2
EYEWASH PACK	1

FIRST AID KIT A50	1
INFANT/EXTN. SEAT BELT	6
INTERPHONE	5
MEGAPHONE	2

PASSENGER ADDRESS	4
PORTABLE EMERGENCY LIGHT	9
TORCH	2
WARNING SIGN -- 'NO EXIT'	2

FIREFIGHTING
EQUIPMENT

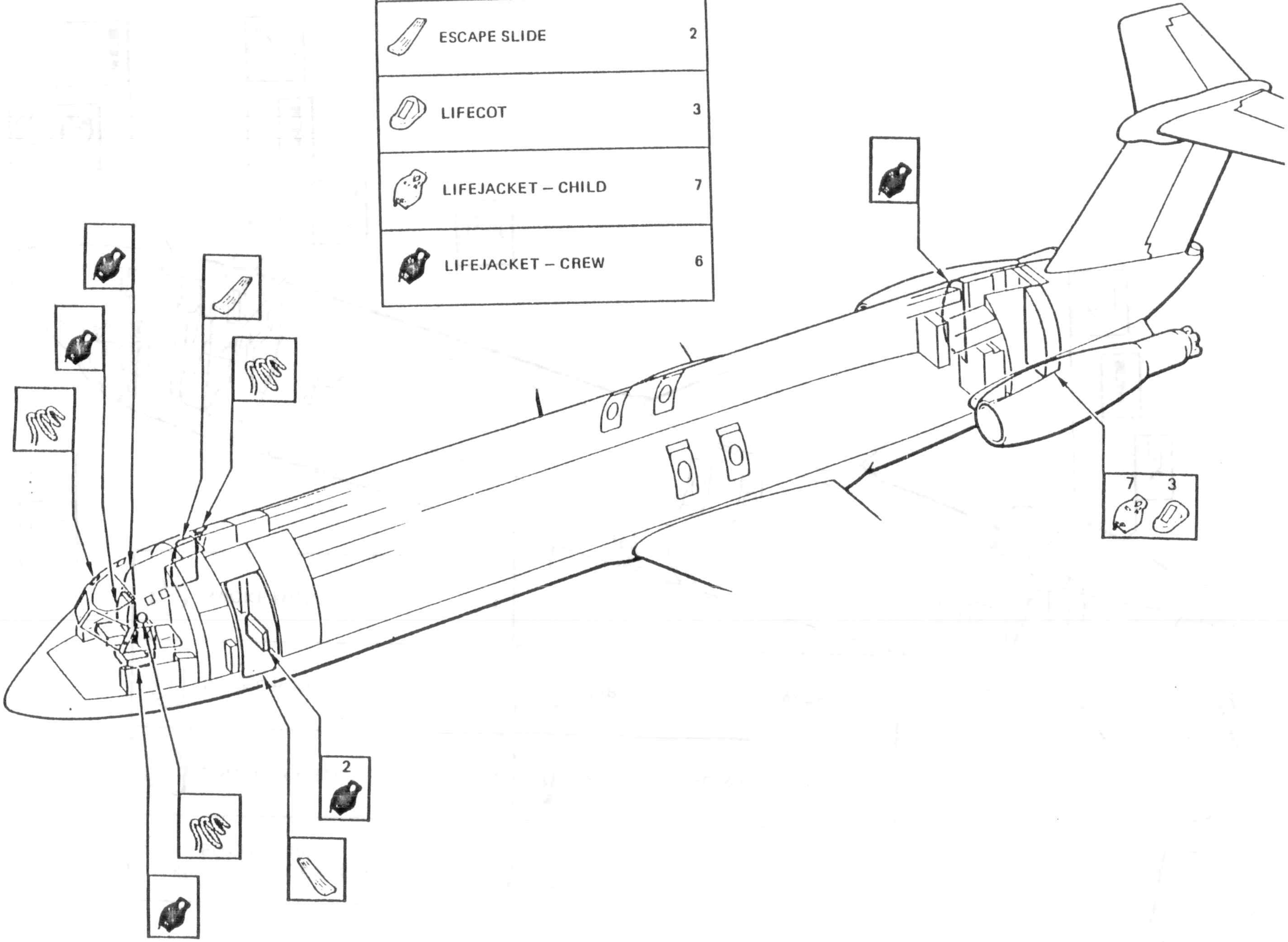


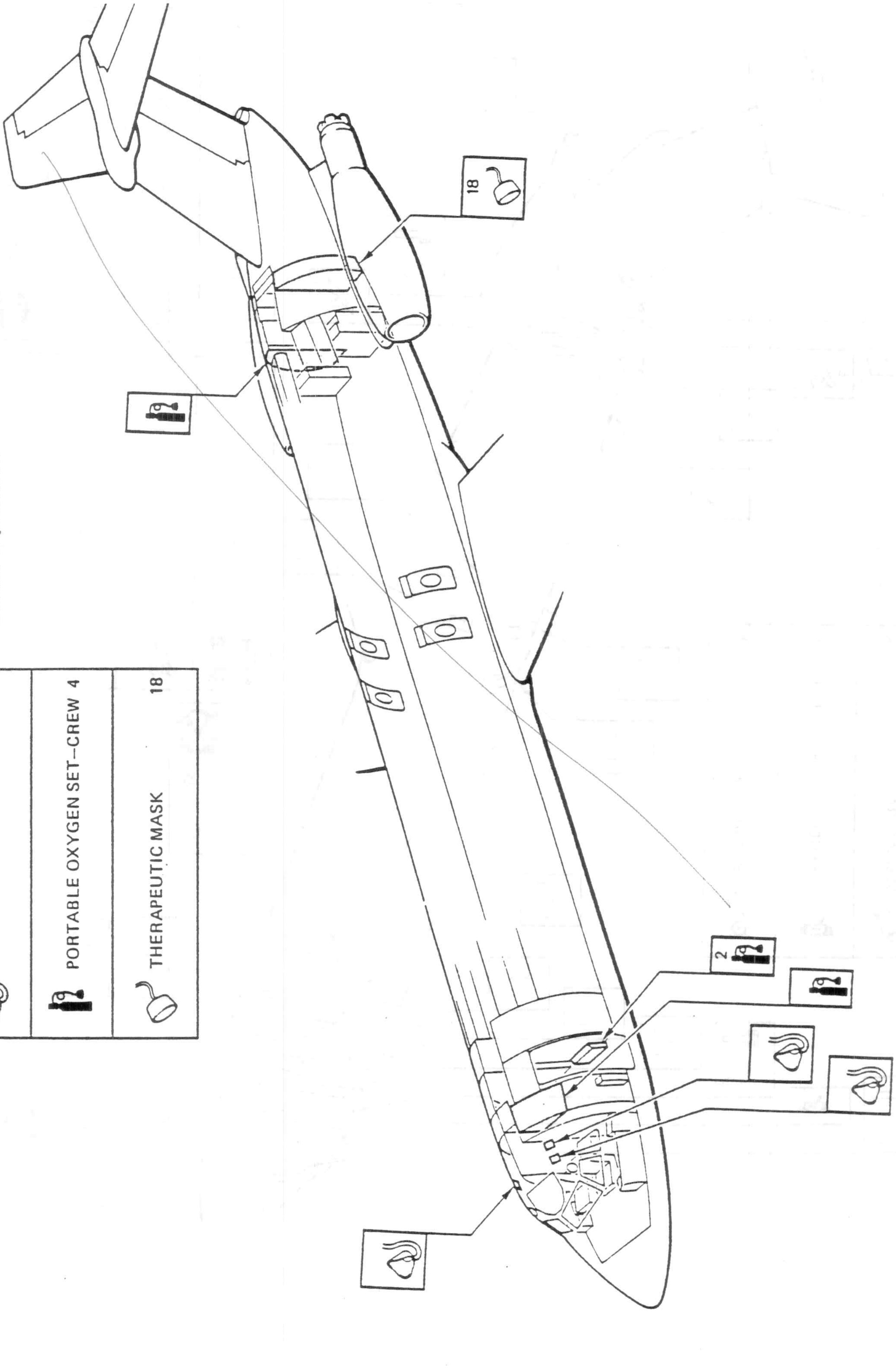
PORTABLE OXYGEN BOTTLE 310L.	1
SMOKE GOGGLES	2
SMOKE HOOD & GLOVES	3
SMOKE MASK	1

AXE	1
FIRE EXTINGUISHER BCF	3
FIRE EXTINGUISHER WATER	1

ESCAPE ROPE	3
ESCAPE SLIDE	2
LIFECOT	3
LIFEJACKET – CHILD	7
LIFEJACKET – CREW	6

EVACUATION EQUIPMENT





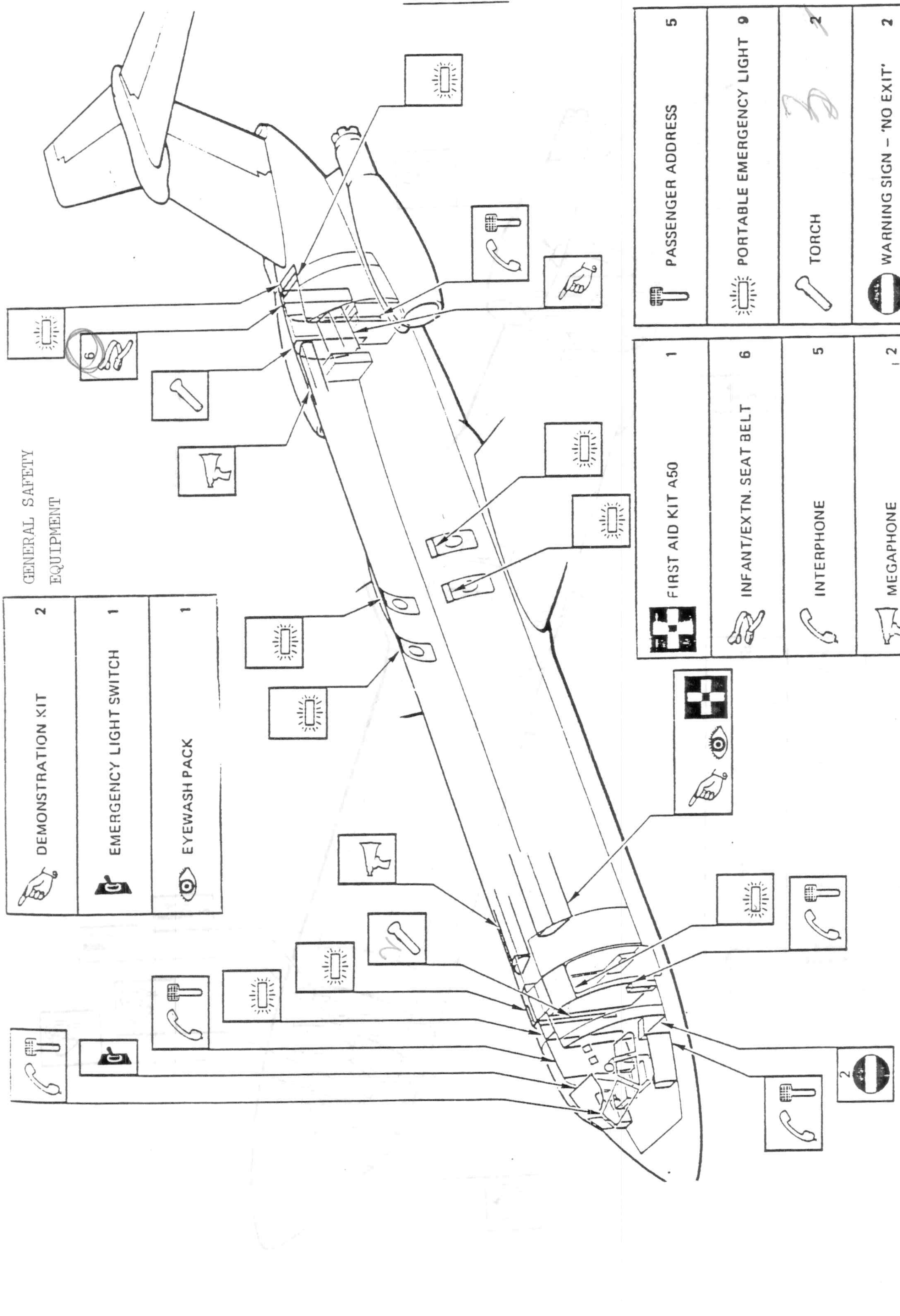
FLIGHT CREW OXYGEN MASK	3
PORTABLE OXYGEN SET–CREW	4
THERAPEUTIC MASK	18

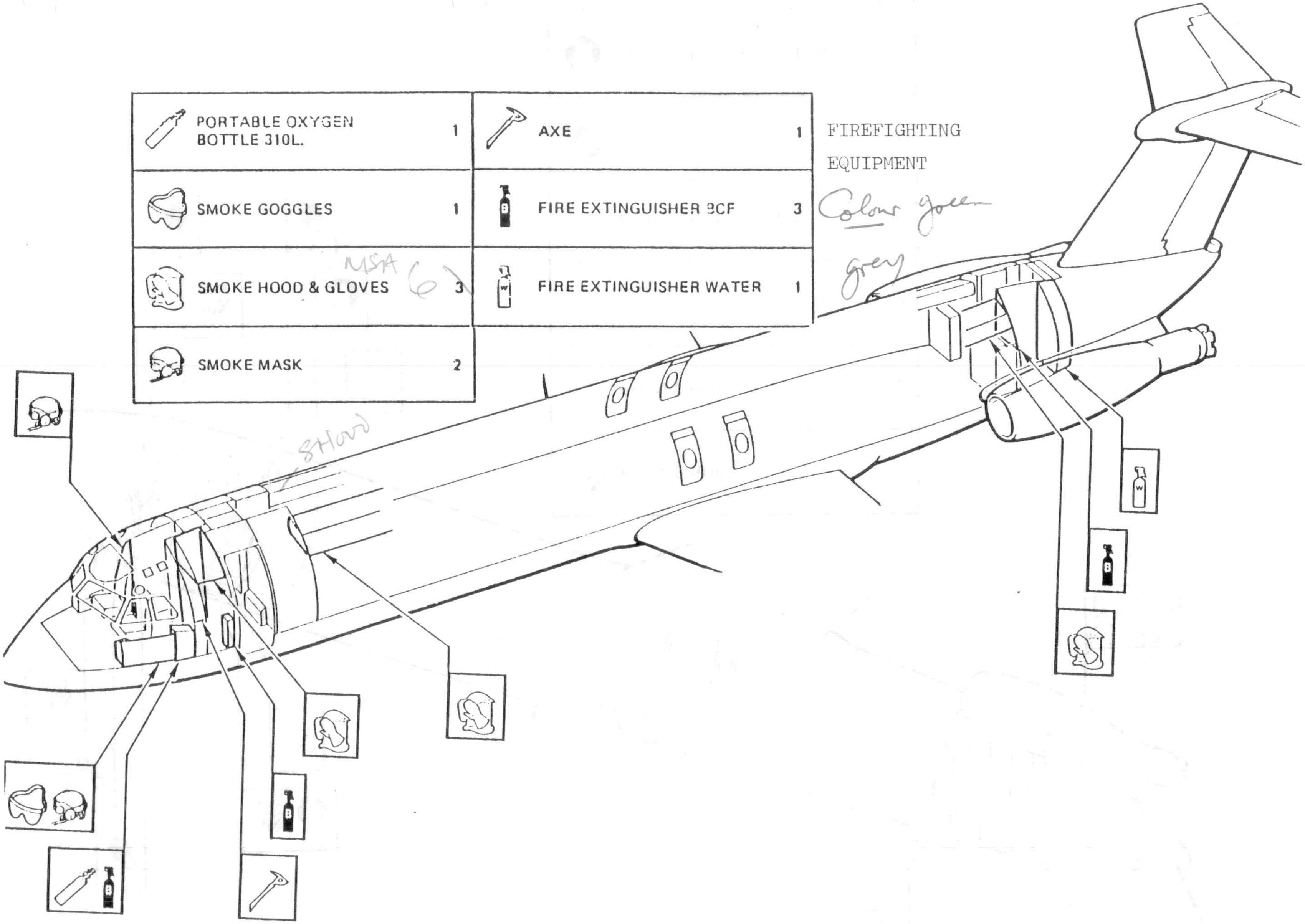
OXYGEN EQUIPMENT

GENERAL SAFETY EQUIPMENT

DEMONSTRATION KIT	2
EMERGENCY LIGHT SWITCH	1
EYEWASH PACK	1

PASSENGER ADDRESS	5
PORTABLE EMERGENCY LIGHT	9
TORCH	2
WARNING SIGN – 'NO EXIT'	2
FIRST AID KIT A50	1
INFANT/EXTN. SEAT BELT	6
INTERPHONE	5
MEGAPHONE	2



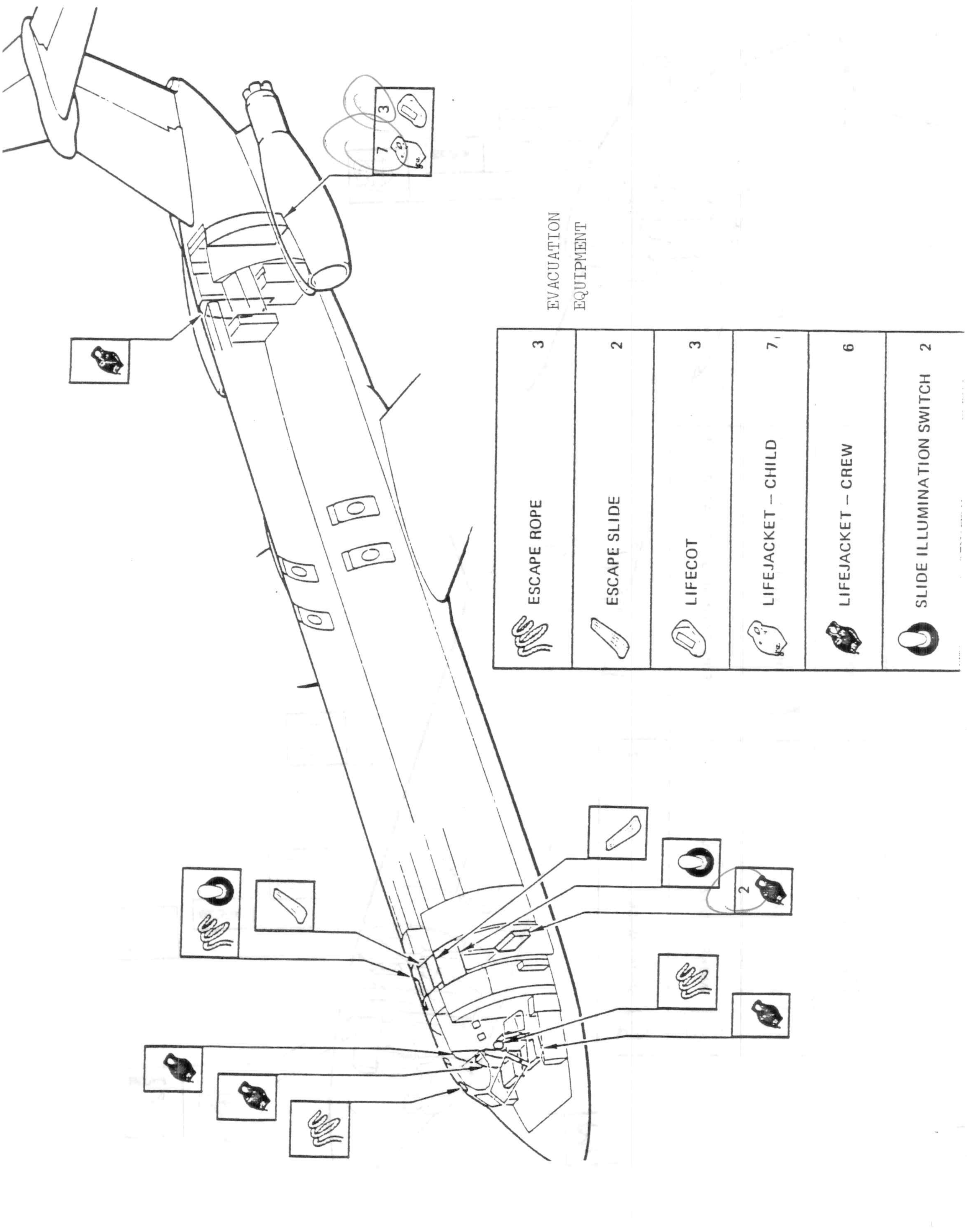


PORTABLE OXYGEN BOTTLE 310L.	1	AXE	1
SMOKE GOGGLES	1	FIRE EXTINGUISHER BCF	3
SMOKE HOOD & GLOVES MSA (6)	3	FIRE EXTINGUISHER WATER	1
SMOKE MASK	2		

FIREFIGHTING
EQUIPMENT

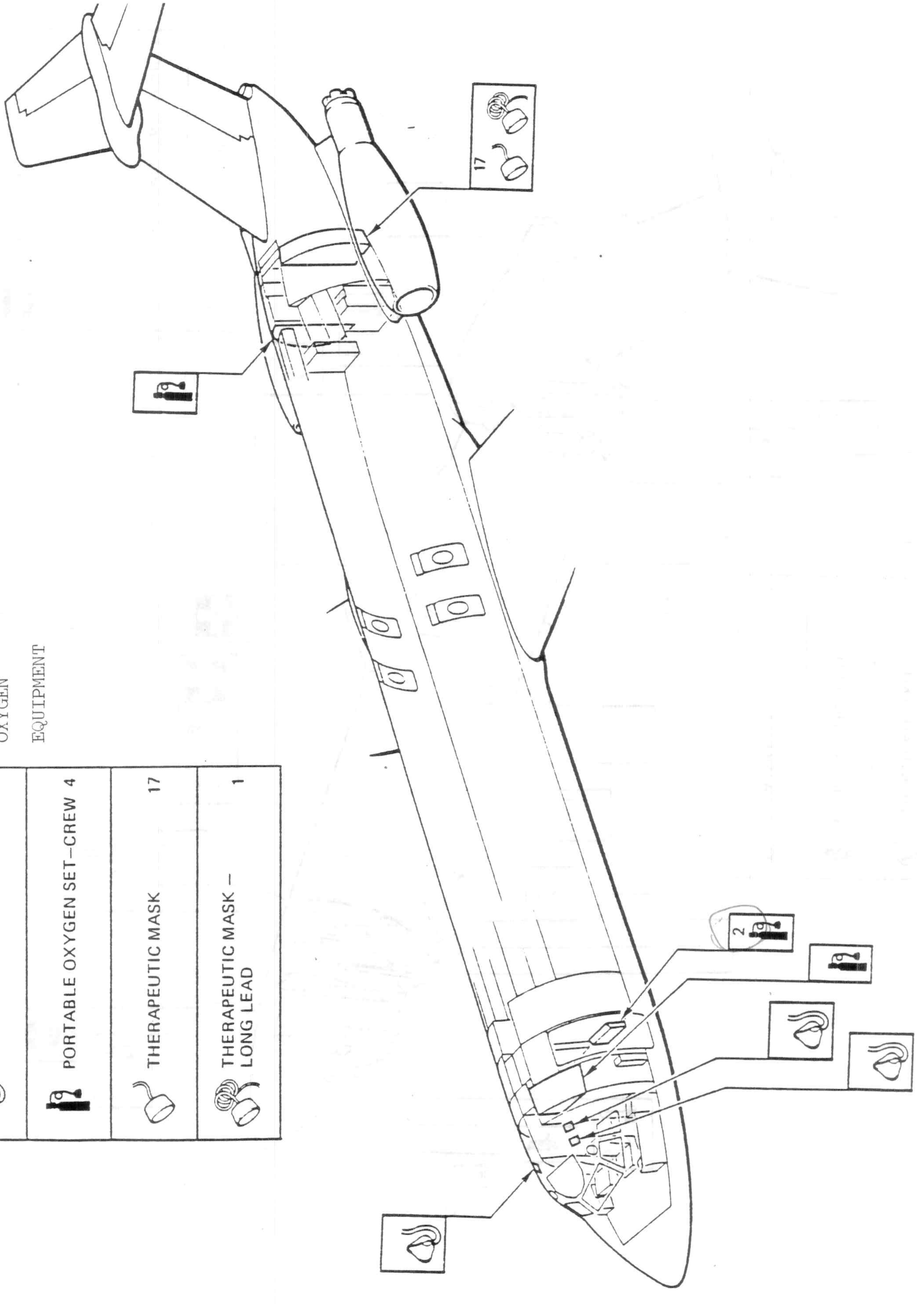
Colour golden
grey

SHood



EVACUATION EQUIPMENT

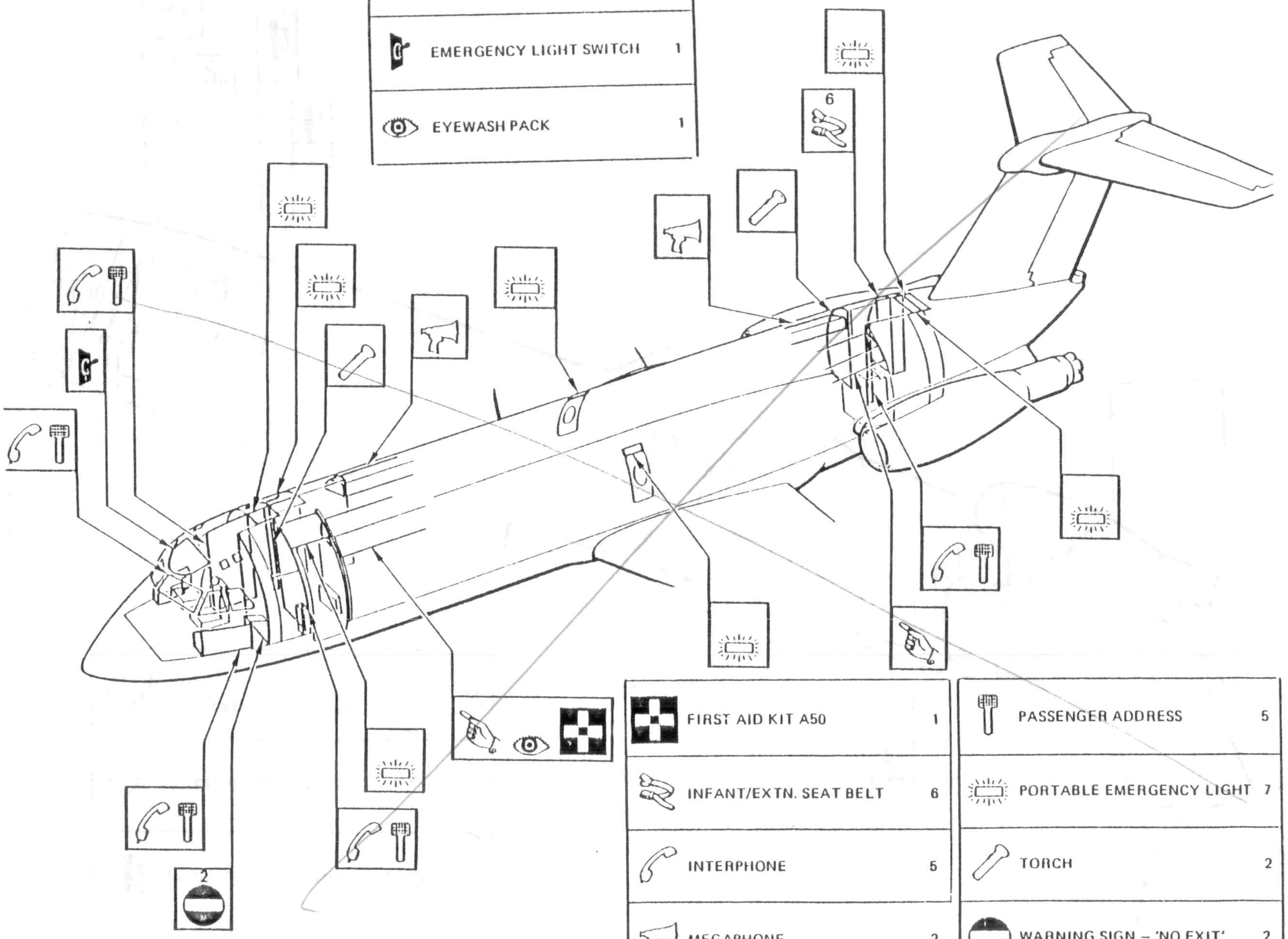
≋	ESCAPE ROPE	3
▱	ESCAPE SLIDE	2
▭	LIFECOT	3
○	LIFEJACKET – CHILD	7
●	LIFEJACKET – CREW	6
◉	SLIDE ILLUMINATION SWITCH	2



OXYGEN EQUIPMENT

FLIGHT CREW OXYGEN MASK	3
PORTABLE OXYGEN SET–CREW	4
THERAPEUTIC MASK	17
THERAPEUTIC MASK – LONG LEAD	1

GENERAL SAFETY EQUIPMENT



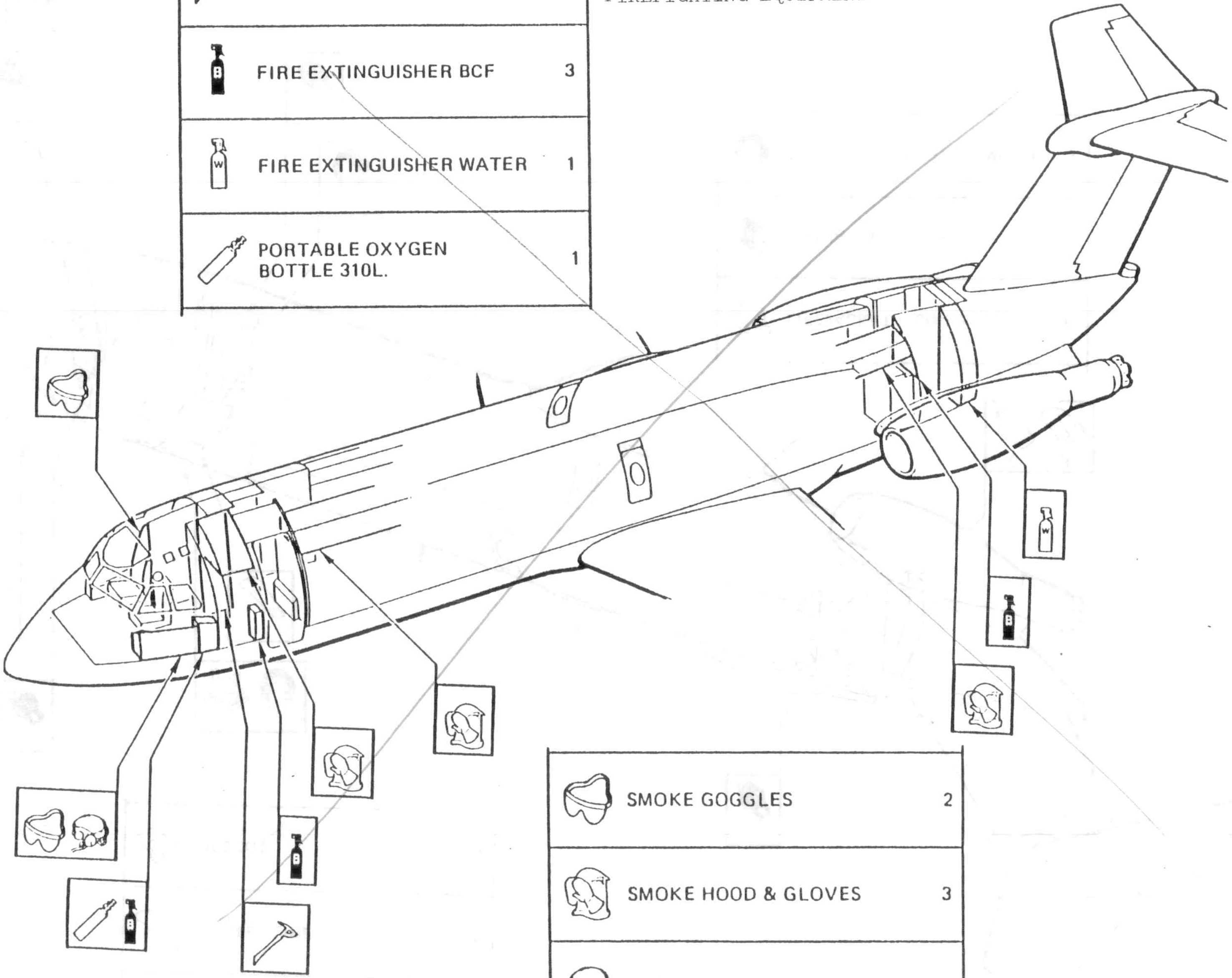
DEMONSTRATION KIT	2
EMERGENCY LIGHT SWITCH	1
EYEWASH PACK	1

FIRST AID KIT A50	1
INFANT/EXTN. SEAT BELT	6
INTERPHONE	5
MEGAPHONE	2

PASSENGER ADDRESS	5
PORTABLE EMERGENCY LIGHT	7
TORCH	2
WARNING SIGN – 'NO EXIT'	2

FIREFIGHTING EQUIPMENT

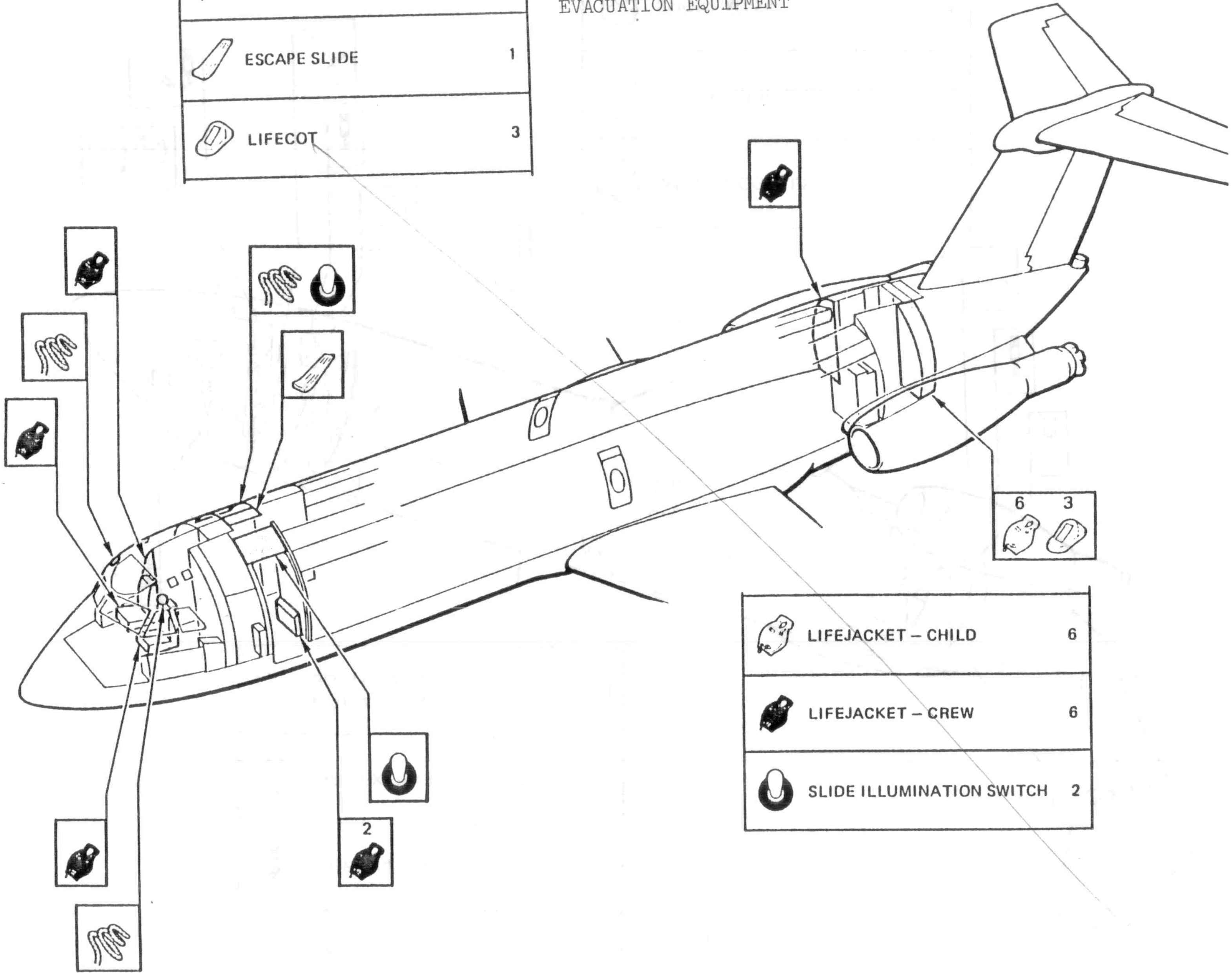
AXE	1
FIRE EXTINGUISHER BCF	3
FIRE EXTINGUISHER WATER	1
PORTABLE OXYGEN BOTTLE 310L.	1



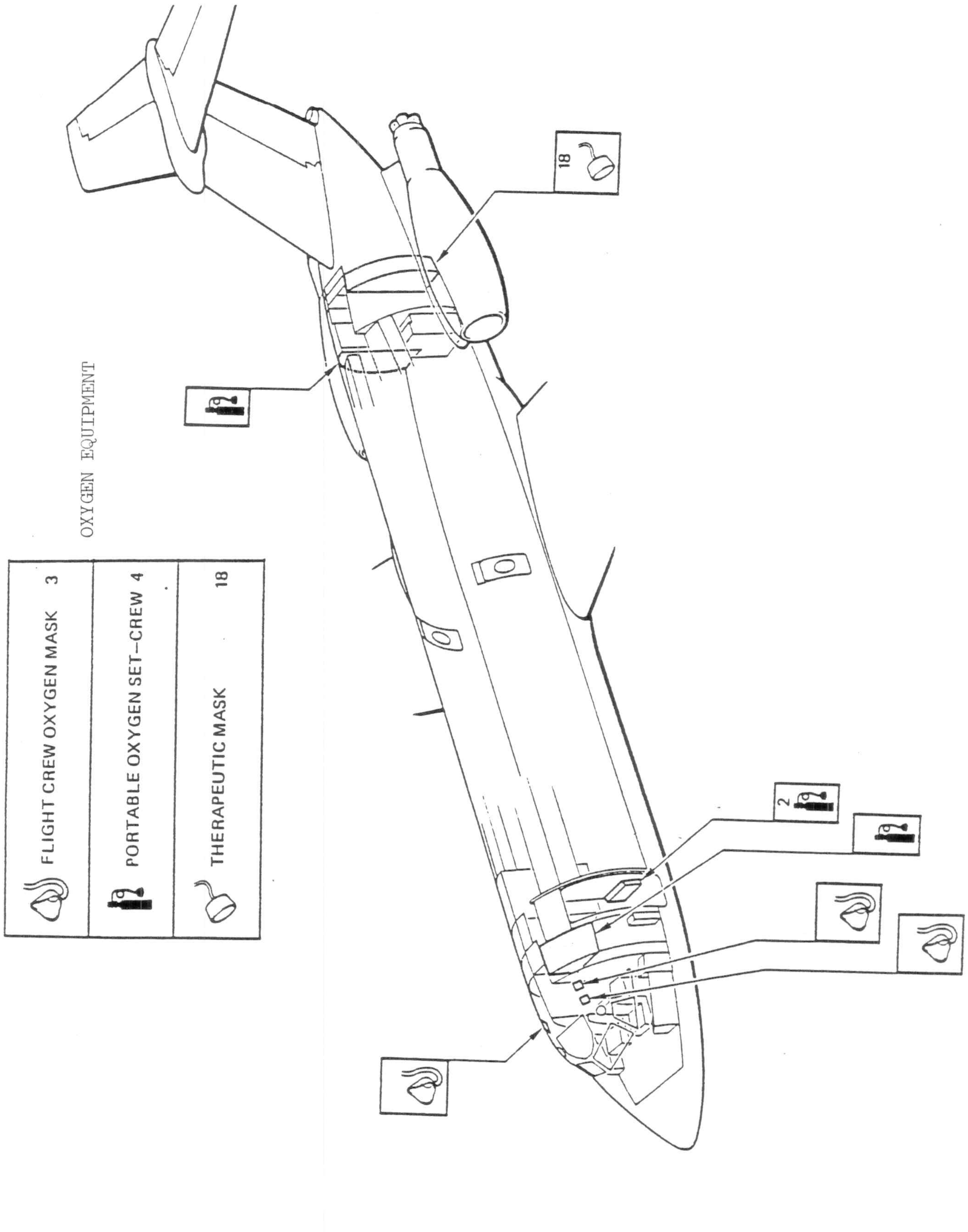
SMOKE GOGGLES	2
SMOKE HOOD & GLOVES	3
SMOKE MASK	1

EVACUATION EQUIPMENT

ESCAPE ROPE	3
ESCAPE SLIDE	1
LIFECOT	3



LIFEJACKET – CHILD	6
LIFEJACKET – CREW	6
SLIDE ILLUMINATION SWITCH	2



OXYGEN EQUIPMENT

FLIGHT CREW OXYGEN MASK	3
PORTABLE OXYGEN SET–CREW	4
THERAPEUTIC MASK	18

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GROUND SERVICING

HYDRAULIC POWER

RESERVOIR SIGHT GLASSES (2),one on each system reservoir in the main landing gear bay. Maximum and minimum fluid levels areindicated by markings on the adjacent instruction label. Reservoir Capacities:

No.1 System- 22 pints.

No.2 System- 30 pints (including emerg reservoir).

GROUND SERVICING PANELS (2), one on each side of fuselage behind main landing gear bay; access via hinged door. Units on each panel comprise:

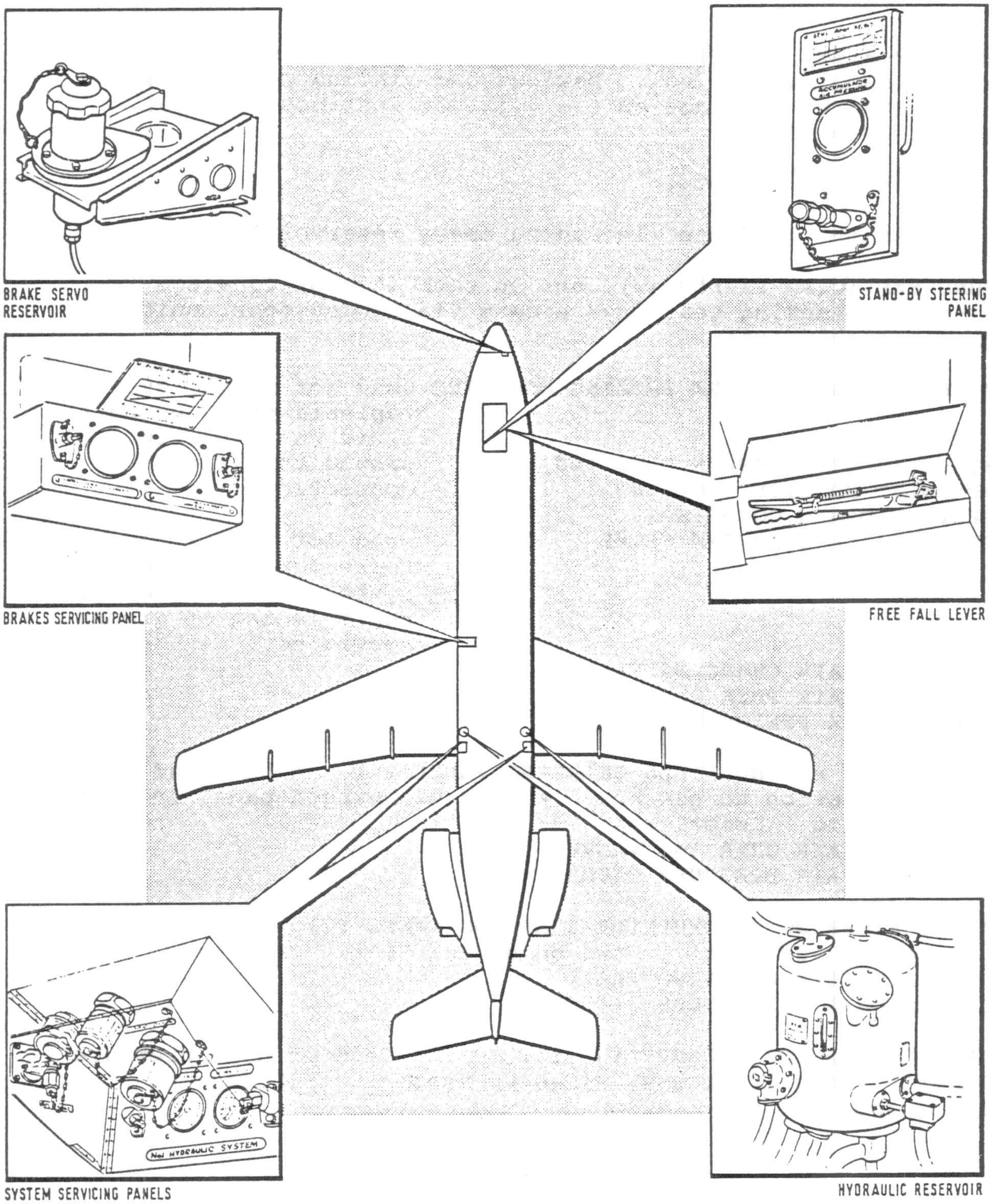
PUMP BYPASS & PRESSURE PRIMING COUPLING	Used for normal system replenishment, using a fluid charging rig.
PUMP DELIVERY PRESSURE COUPLING) **PUMP INLET SUCTION COUPLING**)	Ground test rig connection
RESERVOIR DRAIN COUPLING	
RESERVOIR AIR CHARGING VALVE	Used for repressurising the system reservoir after replenishing or ground servicing.
ACCUMULATOR AIR CHARGING VALVE	
ACCUMULATOR AIR PRESSURE GAUGE	
RESERVOIR AIR PRESSURE GAUGE	

BRAKE SYSTEM ACCUMULATORS CHARGING PANEL (1), on bulkhead fwd of centre section torque box. Access via hinged panel in port bottom fairing. Comprises:
ACCUMULATOR AIR CHARGING VALVE
ACCUMULATOR AIR PRESSURE GAUGE

STANDBY STEERING ACCUMULATOR CHARGING PANEL (1), in nosewheel bay. Access via panel in fwd nosewheel door. Comprises:
ACCUMULATOR AIR CHARGING VALVE
ACCUMULATOR AIR PRESSURE GAUGE

BRAKE SERVO SYSTEM RESERVOIR (1), on fwd face of nose pressure bulkhead. To gain access, hinge up radome. Fitted with filler cap.

HYDRAULIC POWER - GROUND SERVICING POINTS



HYDRAULIC POWER - GROUND SERVICING PROCEDURES

Approved fluid - Skydrol 500B

Caution 1. Skydrol is injurious to the eyes. If splashed in the eyes, wash out thoroughly with clear, cold water. If irritation persists, obtain medical attention.

2. Scrupulous cleanliness is essential during hydraulic servicing.

3. No hydraulic pumps are to be operated whilst checking fluid levels or replenishing.

Preliminaries

1. Chock wheels securely, check brakes off.

2. Open access doors and panels.

3. If the main landing gear doors have to be opened, the system must not be re-pressurised until servicing is completed and all personnel are clear of the wheel bay area.

4. Connect and switch on ground electrical power.

5. Discharge all stored accumulator pressure.
a) Alternately press and release the standby steering.
b) Repeatedly operate the brake pedals and handbrake lever.

6. Release reservoir air pressure by depressing the stem in the centre of the appropriate air charging valve.

Accumulator Air Charging

1. Check accumulator fully discharged.

2. Check accumulator air pressure gauge reading.

3. Remove blanking cap from air charging valve and connect air line.

4. Charge the accumulator with clean, dry air to the appropriate pressure below, or to the pressure extracted from the adjacent temperature/pressure graph for the ambient temperature.

NOTE: When the stand-by steering accumulator requires charging, the nose gear ground lock must be fitted before the

cont/...

system reservoir is charged.

5. Disconnect air line, replace blanking cap on charging valve, check indicated gauge pressure correct, replace access panel and secure.

Nos. 1 and 2 System accumulators - 2,000 psi
Brake System accumulators - 1,000 psi
Standby Steering System accumulator - 1,500 psi

Main Reservoir Replenishing

Ground Servicing Unit Available:

1. Preliminaries completed.

2. Remove cap from Pump bypass and pressure priming coupling, connect servicing unit hose.

3. Check all accumulator air pressures correct.

4. Replenish to 'Max' level of sight glass.

5. Disconnect hose, replace cap.

6. Charge reservoir with air - see Air Charging.

7. Start both AC pumps.

8. Operate each Flying Control system in turn.

9. Check System Quantity gauge pointers register at top of green sector.

Brake Servo System Reservoir Replenishing

1. Chock main wheels securely, check brakes Off.

2. Release radome and prop open.

3. Remove filler cap, and replenish until fluid level is 0.5in. from top of reservoir.

4. Replace filler cap.

5. Operate port and starboard brake pedals individually and in pairs.

6. Re-check fluid level, if necessary top up.

7. Close and secure radome.

Reservoir Air Charging

1. Remove blanking cap from Reservoir air charging valve on appropriate Ground Servicing panel, and connect air line.

2. Charge the reservoir to 38 psi on the Reservoir Air Pressure gauge with clean, dry air.

3. Disconnect air line, replace blanking cap.

Servicing Completed

1. Check all ground servicing equipment withdrawn, clear.

2. Check all access panels, caps for security.

3. Complete Technical Log entry.

LANDING GEAR

BRAKES AND TYRES. See Hydraulics Section, Flying Manual for tyre pressures, limitations, cooling periods, and inspections.

HYDRAULIC SYSTEM (including accumulators). See 'Hydraulics' - Ground Servicing.

TYRE INFLATION VALVES (6) one for each tyre. Permits inflation to the correct pressure with nitrogen or dry air.

BRAKE WEAR INDICATOR PINS (4), one on each wheel hub. Protruding pin, retreating into housing as brakes wear. When head of pin is flush with housing, brake pads require replacing imminently.

FUEL SYSTEM

REFUEL/DEFUEL POINT (1). A self-sealing coupling which allows all tanks to be refuelled or defuelled through valves electrically controlled from the fuel load control panel forward of the refuel/defuel point.

OVERWING REFUELLING POINTS (3). Filler caps which provide access to the tanks for gravity refuelling. That for the centre tank is beneath an access panel. (523 and 539 have no facility for overwing refuelling of the centre tank)

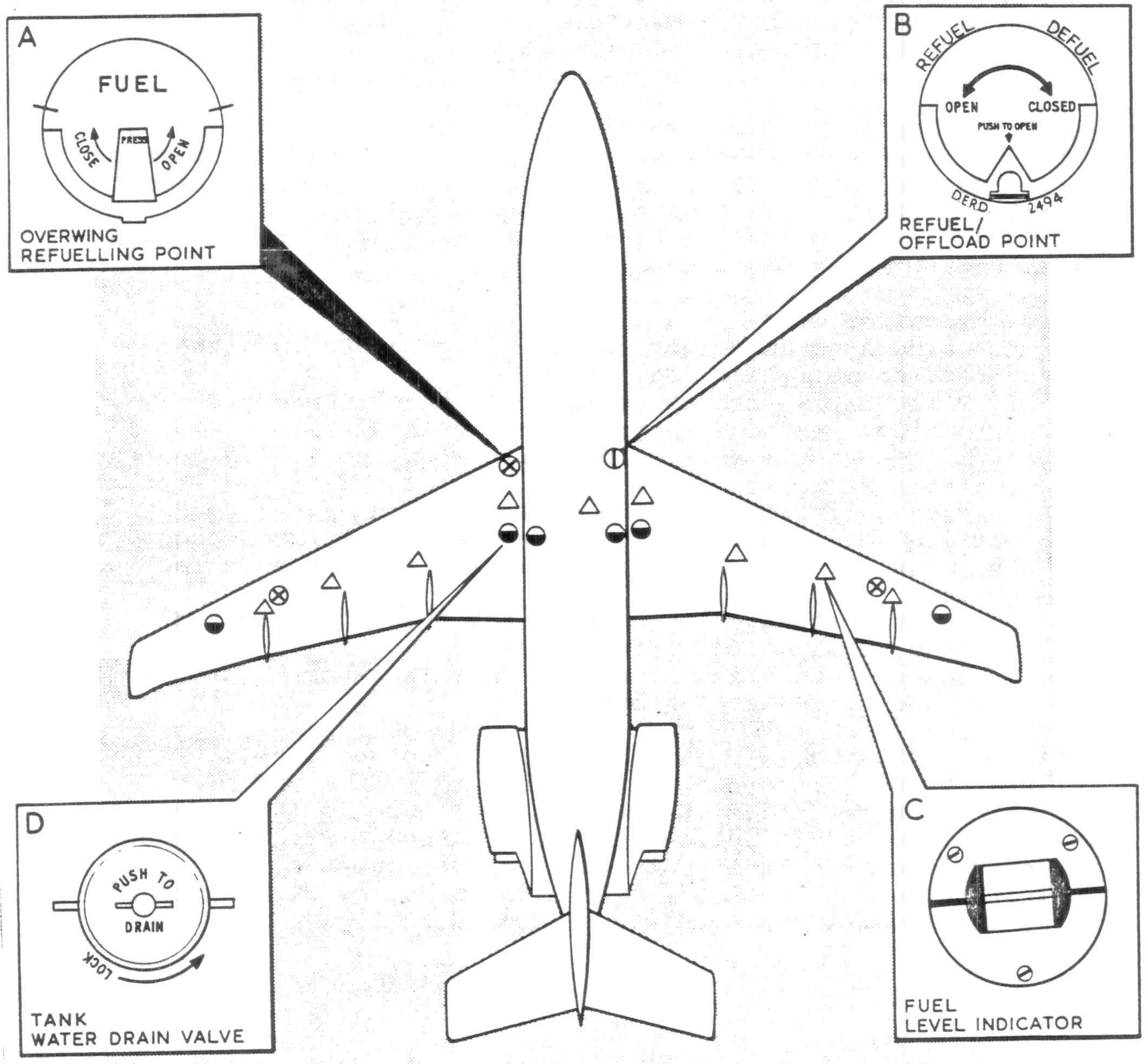
MAGNETIC FUEL LEVEL INDICATORS, (9). Port tank - indicators 1-4, starboard tank - indicators 5-8, centre tank - indicator no.9. Calibrated in divisions from 0 - 18. (510 calibrated in imperial gallons) Use with the attitude indicator and attitude correction charts to measure the tank contents when the aircraft is on the ground.

Instructions for use:

1. Using a screw-driver, press and turn 90o in either direction to release calibrated rod.
2. Pull gently on stowage latch to check correct extension; magnetic attraction should be felt.
3. Read contents marking on calibrated rod, using content register as reference line.
4. Push calibrated rod and stowage latch up through locking cover immediately after use, and turn through 90o to align slot in stowage latch with red lines on locking cover.
5. Release stowage latch and check that it is locked.
6. Read attitude indicator.
7. Using items 3 and 6, obtain true contents figure from attitude correction charts.

ATTITUDE INDICATOR (1), above fuel load control panel. Calibrated in 0.5° squares. Position of bubble centre indicates the deviation of the aircraft's ground attitude from the normal, which is applied to the attitude correction charts to derive the true fuel contents from the magnetic level indicator reading. When the bubble is in square D4 (centre of grid) the level indicators may be read directly.

FUEL SYSTEM GROUND SERVICING POINTS



BLACK ARROW : TOP SURFACE
WHITE ARROW : UNDER SURFACE

WATER DRAIN VALVES (6 for tanks, 6 for pumps, in pump covers). Used to drain off accumulated water and for water content checks, which should be carried out as specified in the Pre-departure Check.

Instructions for use:

Tank drain valve -

1. Using a screwdriver, turn clockwise through 90o.
2. Push spindle up, collect liquid in clean glass container.

Pump drain valve -

1. Unscrew to limit.
2. Push up, collect liquid in clean glass container.

MASTER SWITCH (1), on fuel load control panel - Up 'Off', down 'On'. When set to 'On':

1. Refuel/defuel system is energised from aircraft batteries, APU, or an external supply.
2. Power On lamp comes on.
3. Panel is illuminated.
4. Two relays interrupt the fuel transfer circuits and complete the circuits between the preselector units and their associated refuel/defuel valves and float switches.
5. Transfer cock magnetic indicators show Amber. (400 & 510)

The switch is set to 'Off' by an interference bar when the panel access door is closed.

PUMP DEFUEL SWITCH (1) (Not fitted to 400 and 510), on fuel load control panel - Up 'Close', down 'Open'. When selected 'Open', opens an interconnection between the engine fuel feed system and the refuel/defuel system; with the valve open, the tanks can be defuelled by opening the cross feed cock and the fuel transfer cocks, then switching on booster pumps as required.

The refuel/defuel valve switches should be at Off. When the valve is open, the amber 'valve open' lamp on the centre roof panel comes On.

PUMP DEFUEL INDICATOR LAMP (1) (Not fitted to 400 and 510), on centre roof panel, amber. Comes on when pump defuel valve opens, goes Out when valve closes.

POWER ON LAMP (1), green, on fuel load control panel. Comes on when Master Switch is 'On', to indicate that power supplies

cont/...

are connected to the refuel/defuel system and the pump defuel valve system if fitted.

PRESELECTOR UNITS (3), on fuel load control panel, marked 'Port Tank', 'Centre Tank', 'Starboard Tank'. When the required tank contents is set on the dial, and the Auto/Manual switch selected 'Auto', the refuel/defuel valve is opened to allow fuel to flow to that tank. The selector unit uses the fuel contents gauging system to measure actual tank contents, closing the refuel/defuel valve when the set load is achieved. The gauging system read-out is corrected for an assumed ground incidence of 0.5° nose-down, the flight deck contents gauges calibrated for a flight incidence, and this can result in a discrepancy between total fuel and the flight deck gauge readings.

AUTO/MANUAL SWITCHES (3), on fuel load control panel. One for each tank, up 'Auto', centre 'Off', down 'Manual'. When set to 'Auto' the supply to the associated preselector unit is completed, allowing a tank to be refuelled or defuelled automatically to a pre-determined Level. When set to 'Manual' the supply to the refuel/defuel valve is directly controlled by the Refuel/Defuel switch and the float switches.

REFUEL/DEFUEL SWITCHES (3), on fuel load control panel. One for each tank, up 'Refuel', centre 'Off', down 'Defuel'. Controls the supply to the solenoids of the refuel/defuel valve, either through the preselector unit or directly, according to the setting of the Auto/Manual switch. When refuelling at 'Manual', the flow can be stopped when desired by setting the Refuel/Defuel switch to 'Off', or alternatively when the tank is full by float switches in the tank which interrupt the supply to the refuel/defuel valve. The centre tank has one float switch, while each wing tank has two switches, both of which must operate to allow the valve to close.

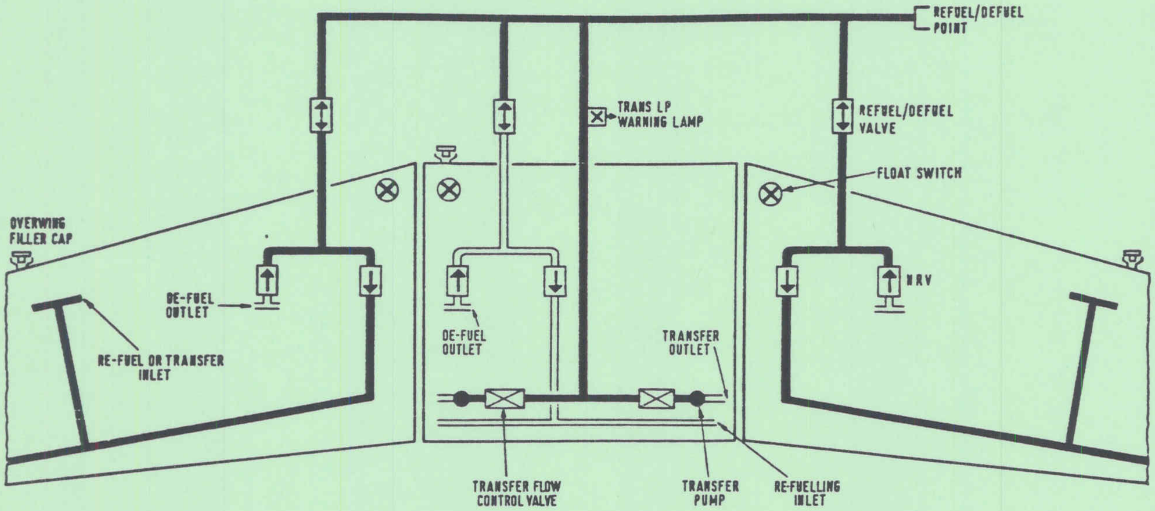
TANK INDICATOR LAMPS (3), green, on fuel load control panel. One for each tank, comes on when;

1. The Auto/Manual switch is at 'Auto' and
2. A fuel level has been set on the preselector unit and
3. The Refuel/Defuel switch is set to 'Refuel' or 'Defuel'.

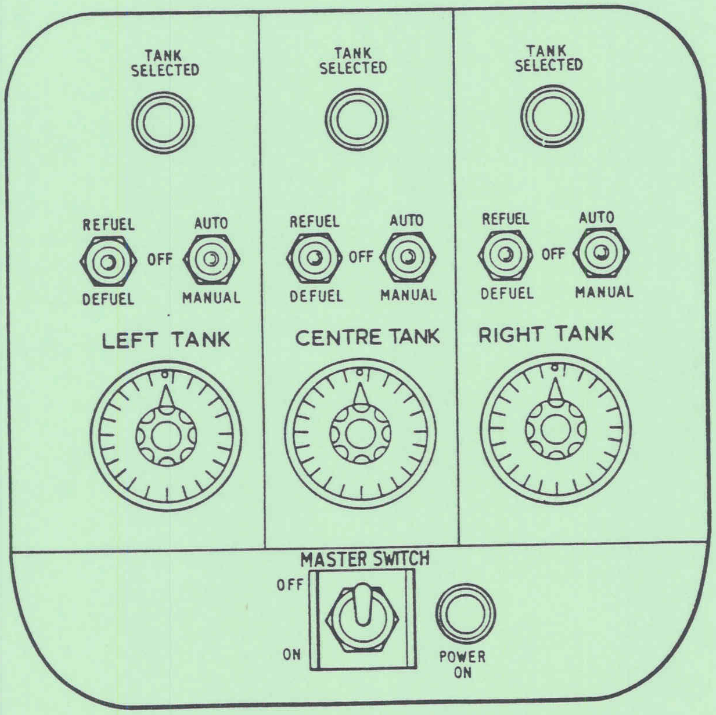
The lamp goes out when the supply to the refuel/defuel valve solenoid is broken, either by operation of the preselector unit or by setting the Refuel/Defuel switch to 'Off'.

DIFFERENCES

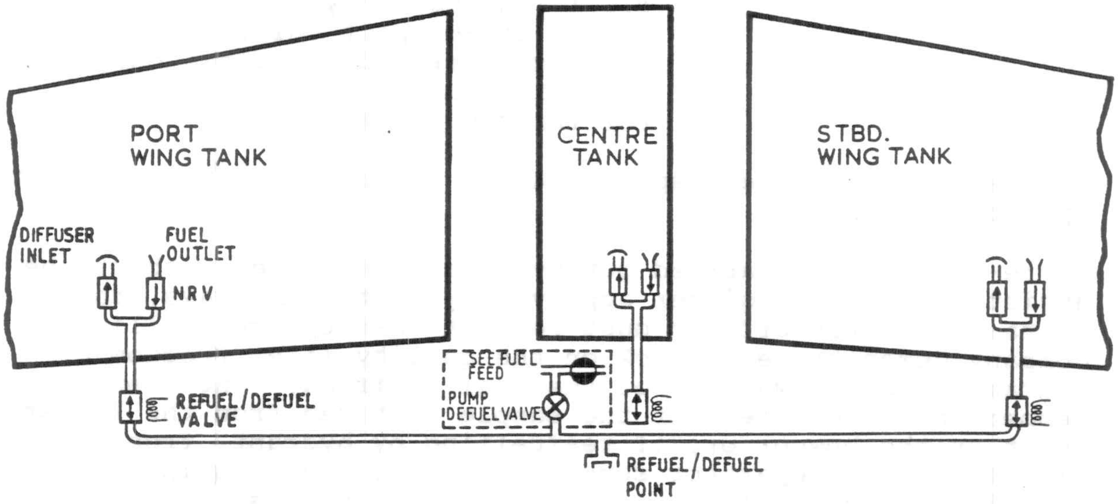
REFUEL/DEFUEL SYSTEM 510 &400

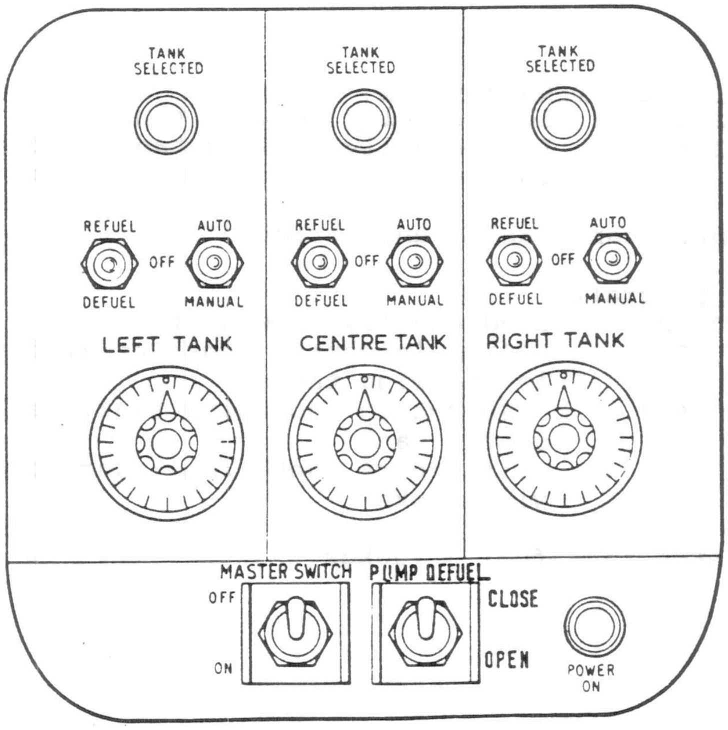


SOLID BLACK LINES INDICATE PIPES PRESSURISED AS DURING FUEL TRANSFER



REFUEL/DEFUEL SYSTEM (500 excl 510)





FUEL LOAD CONTROL PANEL

FUEL SYSTEM - GROUND SERVICING PROCEDURES

PRELIMINARIES

Fuel specification -

D.E.R.D. 2494
T.C.1 (in USSR only)
TSZ-1 (at Budapest only)
T1 (Bucharest and Constanza only)
PL5, PL6 (Prague only)
PS2 (Krakow only)

If fuel of the correct specification is not available, contact Operations Control.

If re-fuelling is carried out by Flight Deck crew without the assistance of an engineer approved by British Airways, the Captain or First Officer must request that the re-fuelling company demonstrate a check on the quality (i.e. freedom of contamination by water), of the fuel uplifted. The crew member should ensure that the sample is taken from the lowest point on the bowser or, if re-fuelling by hydrant, from the microfilter or separator sump. The water check equipment, supplied by the re-fueller, will normally consist of a chemical which is extremely sensitive to moisture. If in doubt contact BA Operations Control at LHR.

Specific gravity - for fuel loading purposes a mean specific gravity of 0.7936 is assumed, whereby 1 Imp. gal = 3.60 kg.

Fuel Loading -

500 series aircraft except 510

Up to 8,082 kg	-	Load equally in wing tanks.
Above 8,082 kg	-	Load equally in wing tanks until filled, then remainder in centre tank.

minimum centre tank fuel - unrestricted

510 series aircraft

Up to 7,600kgs	-	Load equally in wing tanks
7,600 to 8,300	-	700kgs in centre tank, remainder equally in the wing tanks
8,300 to 10,678	-	3,800kgs in each wing tank, remainder in centre tank
above 10,678	-	Fill centre tank, remainder equally in wing tanks

minimum centre tank fuel - 700kgs

400 series aircraft

Up to 8,000kgs - Load equally in wing tanks
8,000 to 9,050 - 1000kgs in centre tank, remainder equally in the wing tanks
9,050 to 11,100 - 4,025kgs in each wing tank, remainder in centre tank
above 11,100 - Fill centre tank, remainder equally in wing tanks

minimum centre tank fuel - 1000kgs

There must not be more than 500 kg difference between the contents of the wings tanks, above the minimum fuel for take-off of 2,200 kg.

If one wing tank cannot be filled, the other must be filled to the same level, and the remainder of the fuel must be put in the centre tank. However, the centre tank contents must now be included in the zero fuel weight, only the wing tank contents being deducted from the total loaded weight.

If refuelling on uneven ground, park the aircraft facing up or down the slope. To avoid aircraft delays, a difference of up to 200 kg between total departure fuel and the sum of the flight deck contents gauge readings is acceptable.

Comply with the safety precautions given in Flight Crew Orders

PRESSURE REFUELLING OR SUCTION DEFUELLING
AUTOMATIC FUEL LOAD CONTROL

Maximum refuelling rate	410 Imp. gal/min.
Maximum refuelling pressure	53 psi.
Maximum defuelling rate	130 Imp. gal/min.
Maximum suction	8 psi.

Tanks being refuelled or defuelled should be done simultaneously.

1. Electrical supply - aircraft battery, APU, or 200/115V 3ph. 400c/s external supply.

2. Ascertain fuel load required.

3. Defuelling only - operate tank water drain valves

4. Check contents of each tank, using fuel level indicators and attitude indicator for the wing tanks, and the fuel quantity gauge for the centre tank. (The fuel level indicator in the centre tank is inaccessible and should be ignored unless the quantity gauge reading is suspect)

cont/...

5. Bond tanker or hydrant to aircraft.

6. Remove coupling cover and connect hose to coupling.

7. Open access door to fuel load control panel.

8. Master switch - 'On', Power On lamp on.

9. Appropriate Auto/Manual switches -'Auto'. Refuel/defuel switches - as required.

10. Preselector units - set required load for each tank. Check that Tank indicator lamps are on.

11. Operate tanker or hydrant.

12. As each tank reaches the selected load, its indicator lamp will go out.

13. Check contents of each tank, as in item 4. Adjust loads if necessary.

14. All Auto/Manual switches - 'Off'.
    All Refuel/Defuel switches - 'Off'.
    Master Switch -'Off', Power On lamp out.

15. Close and secure the fuel load control panel access door.

16. Disconnect hose and bonding. Fit cover to coupling.

17. Refuelling only - operate tank water drain valves.

18. Check fuel level indicators and water drain valves closed and locked.

19. Electrical supply - as required.

20. Check fuel uplift/offtake with supplier. Complete the Technical Log.

MANUAL FUEL LOAD CONTROL

As for Automatic Fuel Load Control up to and including item 8.

9. Appropriate Auto/Manual switches -'Manual'. Refuel/Defuel switches as required.

10. Operate tanker or hydrant.

11. Using the tanker or hydrant meter as a guide, set the Refuel/Defuel switches to 'Off' when the desired tank contents are reached.

cont/...

12. Continue with item 13 of Automatic Fuel Load Control.

OVERWING REFUELLING

1. Ascertain fuel load required.

2. Check contents of each tank, using fuel level indicators and attitude indicator for the wing tanks, and the fuel quantity gauge for the centre tank. (The fuel level indicator in the centre tank is inaccessible and should be ignored unless the quantity gauge reading is suspect).

3. Bond tanker or hydrant to aircraft.

4. Place wing mats in position to protect top surfaces and leading edges.

5. Connect hose nozzle to bonding socket beside refuelling point cap, then remove cap and insert nozzle.

6. Refuel to required load.

7. Withdraw nozzle, disconnect bonding, replace cap.
8. Ensure cap correctly locked and, for centre tank, access panel closed and fastened.

9. Remove wing mats.

10. Check contents of each tank, as in item 2. Adjust loads if necessary.

11. When refuelling has been completed, disconnect tanker or hydrant bonding.

12. Operate water drain valves.

13. Check fuel level indicators and water drain valves closed and locked.

14. Check fuel uplift with supplier. Complete the Technical Log, writing 'Overwing' below the words 'Fuelling Completed' in the certification box.

PUMP DEFUELING

not available on 400 and 510

To defuel centre tank use the fwd & Transfer booster pumps to transfer the fuel to the wing tanks, when the following procedure can be used. NB. Ensure there is sufficient empty wing capacity first or fuel may be vented overboard. If there is insufficient capacity pump defuel the wing tanks first.

1. Complete items 1 to and including 8 of the Automatic Fuel Load Control procedures. The aircraft batteries must not be used for pump defuelling.

2. Pump Defuel Valve switch - Open.

3. Refuel/Defuel switches - Off.

4. Check amber lamp, centre roof panel - On.

To Defuel Starboard Tank:

5. Fuel Crossfeed cock - Open.

6. Booster pumps - Both On, stbd tank.

7. Booster pumps - Both Off when stbd tank defuelled.

8. Fuel Crossfeed cock - Close.

To Defuel Port Tank:

9. Booster pumps - Both On, port tank.

10. Booster pumps - All Off when port tank defuelled.

11. Pump Defuel valve - Close, check lamp out.

12. complete items 13 to and including 20 of the Automatic procedure.

ENGINES

ENGINE OIL FILLING PRESSURE CONNECTIONS (2), one on the lower port side of each main engine.

Oil tank capacity - 7 litres (12 pints) to 'Full' mark.
System total capacity - 12 litres (24 pints)
Usable oil - 5 litres (9 pints)
Oil specifications - Castrol 325 or WPS293. (Approved alternatives Aeroshell 390, Castrol 3C.

The required minimum oil level before flight is:-
First flight of day - *Full
Departure from base - 1 litre (2 pints) below Full.
Sector exceeding 2 hr - 1 litre (2 pints) below Full.
Departure from any other Station, provided sector does not exceed 2 hr - 2 litres (4 pints) below full.

*When replenishing from litre cans, it is permissible to exceed Full by 0.5 litre (1 pint).

Max Oil consumption - 0.75 litre/hour, averaged over last ten sectors.

When the consumption exceeds 0.5 litre/hour, averaged over last ten sectors, the tank must be full on every departure - See Tech Log for information on oil consumption monitoring.

ENGINE STARTING

Suitable Ground Air Supply Units;
- Blackburn Air Starter (Palouste).
- Hampson Airmaster.
- Auto-Diesel Gas Turbine starter
- IV Pressure Controller air bottle trolley.
- Atlas Copco Air Partner
- Air Research Gas Turbine starter.

GROUND AIR CONNECTION (1), in stbd engine stub fairing. Provides inlet connection for ground air supply from suitable unit, for engine starting with no internal air supply function.

APU GROUND SERVICING

Oil tank capacity - 0.83 Imp. Gallons (6 pints useable)
Oil specification - Castrol 325, Castrol 3C, WPS 293

The gravity and pressure oil filler caps are on the APU oil tank

AIR CONDITIONING

PRESSURE RELIEF VALVE (2), in engine nacelle stub wings. If the pressure reducing valve and also the pressure sense override should fail, the pressure relief valve would operate. Normally flush with the under surface of the rear stub wing, the valve protrudes when it has operated, and can be reset only on the ground by replacement of the shear pins.

GROUND CONDITIONING CONNECTION (1), below port leading edge. Enables the aircraft to be ventilated by a ground air supply when its own system is inoperative; the Master Valves must be closed and the Discharge Valve must be fully opened by the Air Dump Valve control before the supply is connected. The supply is introduced directly into the distribution system.

OXYGEN SYSTEM

CHARGING VALVE (1), on port side of electrics bay. Enables the storage cylinder to be recharged in situ. Should the pressure in the system become excessive for any reason, a bursting disc will rupture, discharging the oxygen overboard through a vent pipe.

CYLINDER STOP VALVE (1), on head of storage cylinder. Normally wirelocked open.

OXYGEN CONTENTS GAUGE (1), beside the Charging Valve. Identical to that on the starboard console, it is for use when re-charging the storage cylinder.

GROUND HANDLING

LANDING GEAR GROUND LOCKS (3), in stowage in port console. Landing gear ground locks are to be fitted in the event of reported unserviceability of the downlock mechanism, and when specified in the Maintenance Schedules. Their use is otherwise discretional, but should be considered when towing or parking the aircraft and during extended aircraft unserviceability.

Whenever ground locks are fitted only those carried on the aircraft are to be used.

TOWING

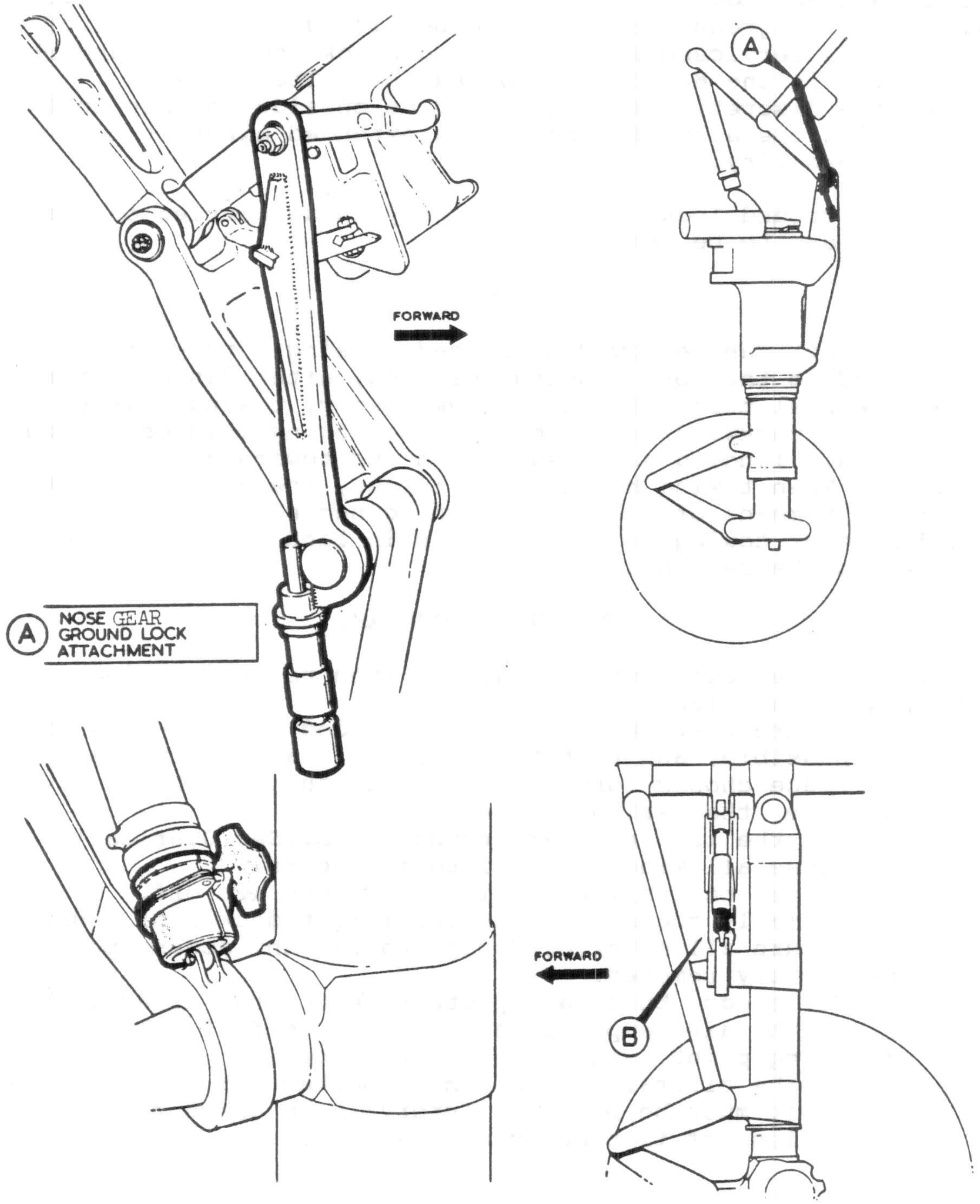
The aircraft can be towed or pushed, using a tow-bar connected to the nose landing gear leg, after disconnecting the nosewheel torque links. In emergency, towing either forward or backward can be done using towing bridles attached to the main landing gear legs, with one towing vehicle on each bridle. When towing bridles are in use, the aircraft must be steered by means of a steering arm connected to the nose landing gear towing lugs, and the main landing gear fixed doors must be removed.

PARKING PROCEDURES

Following the Full Shutdown Checks, when no engineering coverage is available:-

1. Ensure that the aircraft is headed into wind, wherever possible, and that the nosewheels are centralised.
2. Place chocks forward and aft of the mainwheels. Release the parking brake.
3. Fit the landing gear ground locks. (See Overleaf)
4. Close all windows and interior doors.
5. Ensure that all electrical services are off. (Especially the nav lights and flight deck roof light)
6. Secure all exterior doors and fit any access panels previously removed.
7. Fit plugs, bungs and protective covers, if available.
8. If the air temperature is likely to fall below freezing point, drain the water system.
9. If the aircraft is to remain parked for more than 48 hours it must be moved at intervals to prevent the formation of flat spots on the tyres.

LANDING GEAR GROUND LOCKS



(A) NOSE GEAR GROUND LOCK ATTACHMENT

(B) MAIN GEAR GROUND LOCK ATTACHMENT

MOORING PROCEDURE

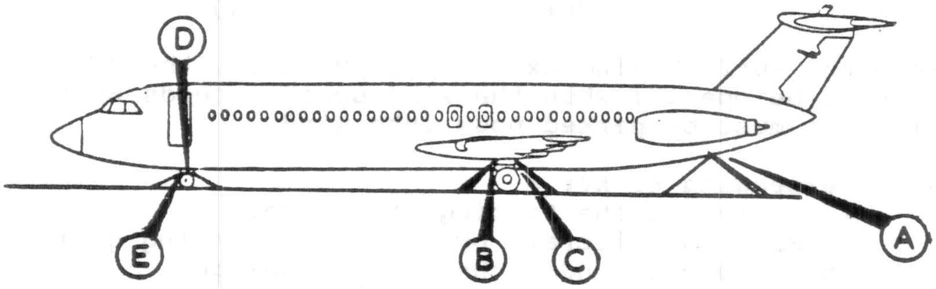
(see diagram overleaf)

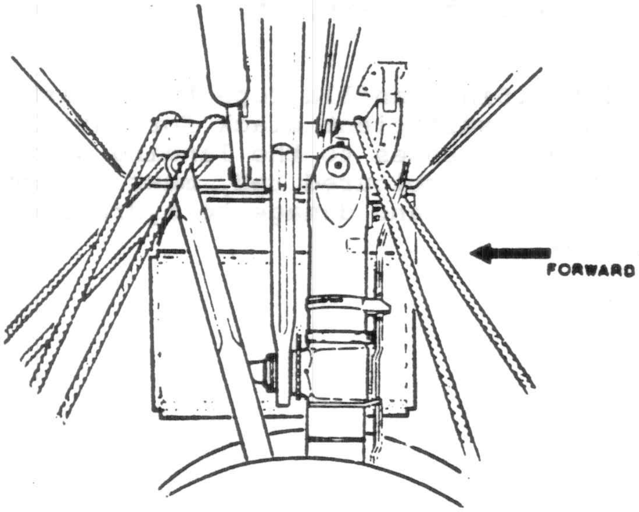
When the surface wind exceeds fifty knots, the forward doors mustnot be opened; when the wind speed exceeds 65 kt, the aircraft must be parked nose into wind.

Winds exceeding 65 kt:
1. Carry out the Parking Procedure.
2. Moor the aircraft by the three landing gear legs and the eye-bolt under the rear fuselage.
3. Remove servicing platforms, steps, etc., to a safe distance.

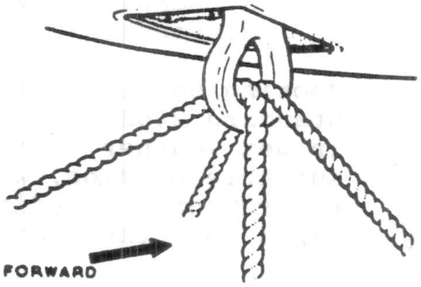
Mooring should be done with 3.5in. manilla rope to British Standard 2052 Grade 1, leaving sufficient slack for shrinkage in wet weather. When fixing the ropes to the landing gear, suitable padding, which should be coloured red, must be used to prevent chafing of the ropes and damage to hydraulic pipes and other components.

MOORING PROCEDURE

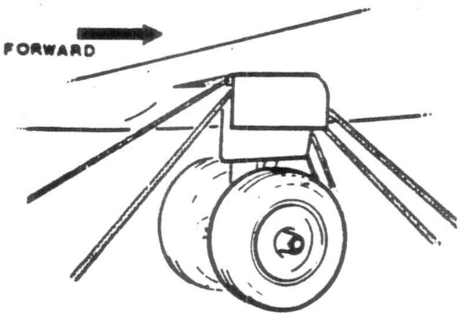




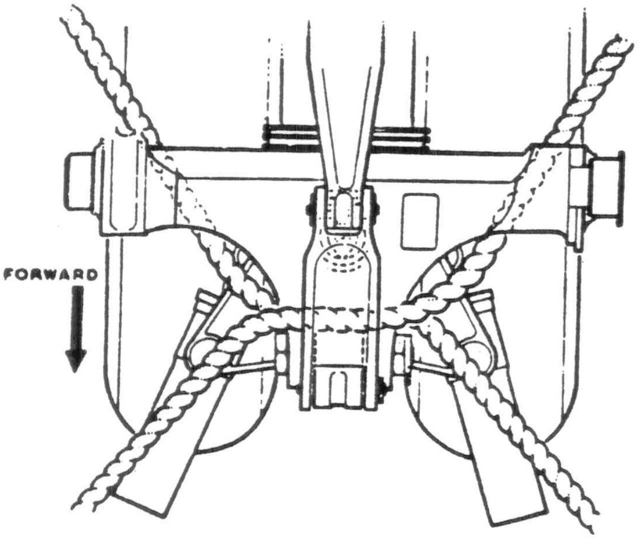
Ⓑ MAIN GEAR LOOKING OUTBOARD



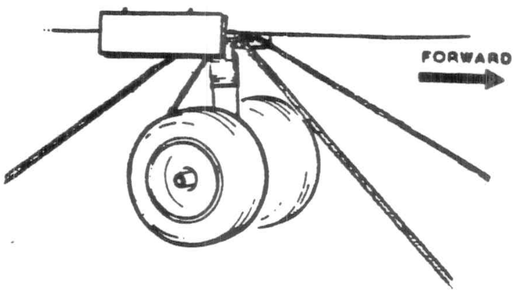
Ⓐ REAR EYE-BOLT



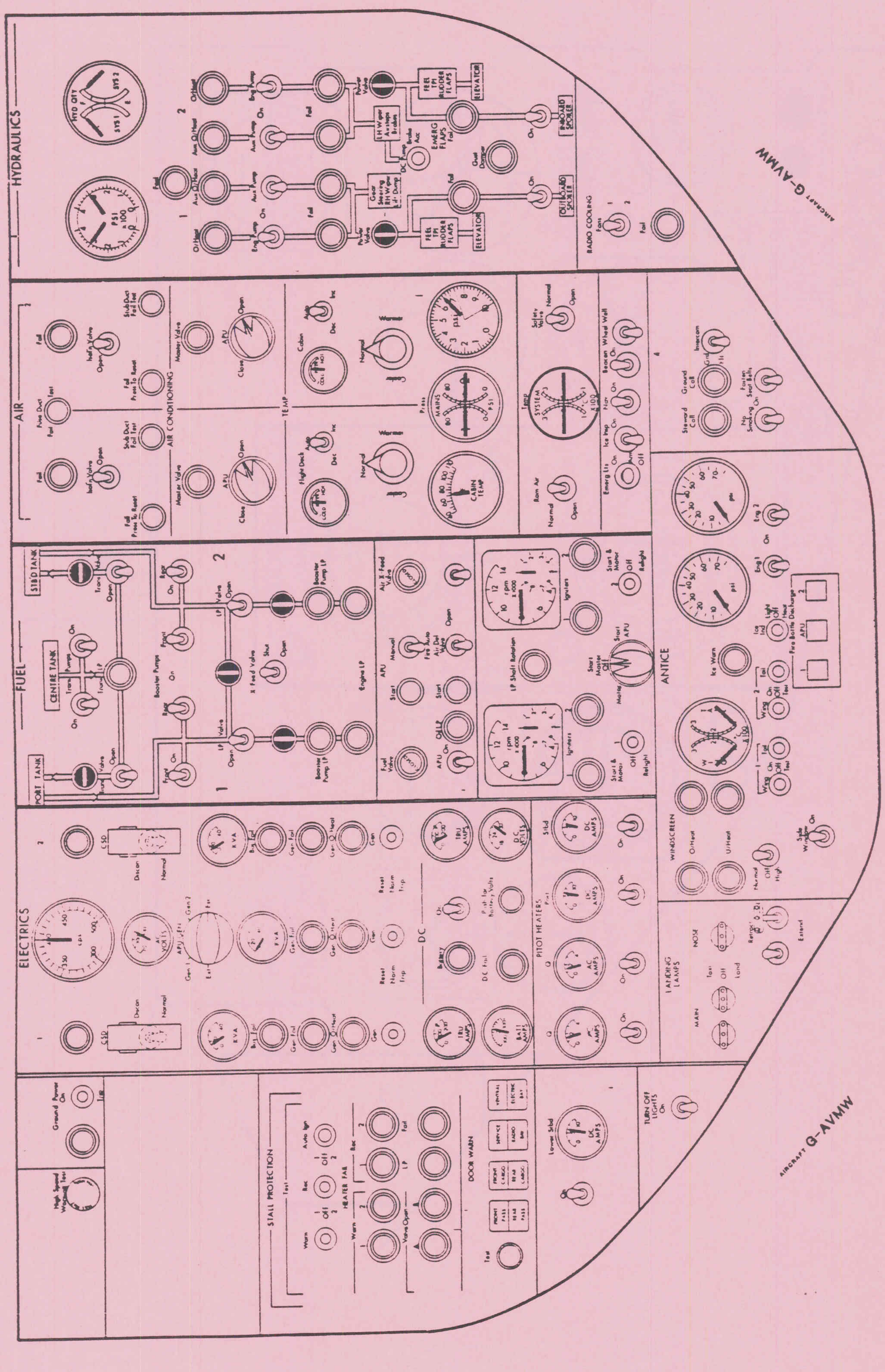
Ⓒ MAIN GEAR



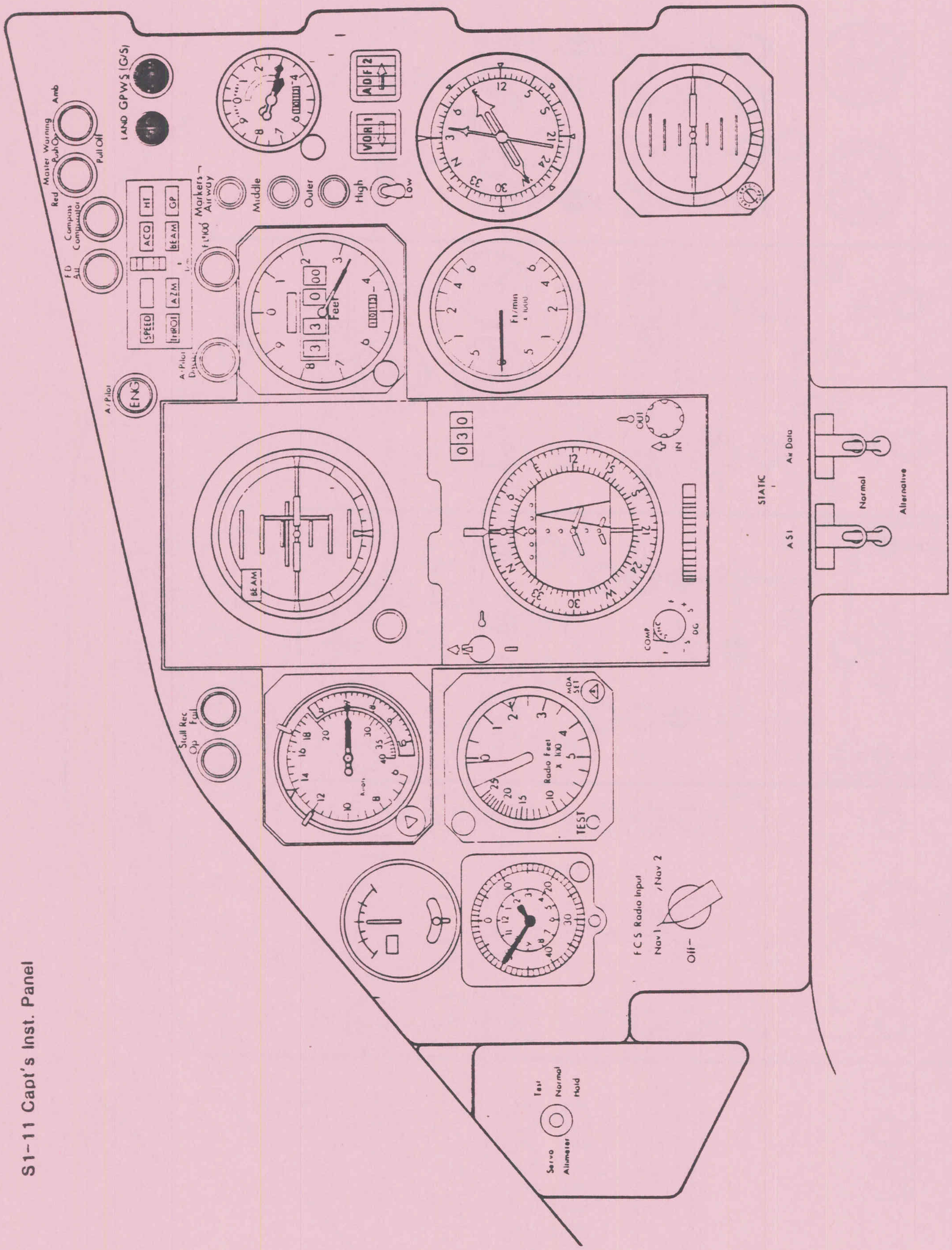
Ⓓ NOSE GEAR VIEW FROM ABOVE



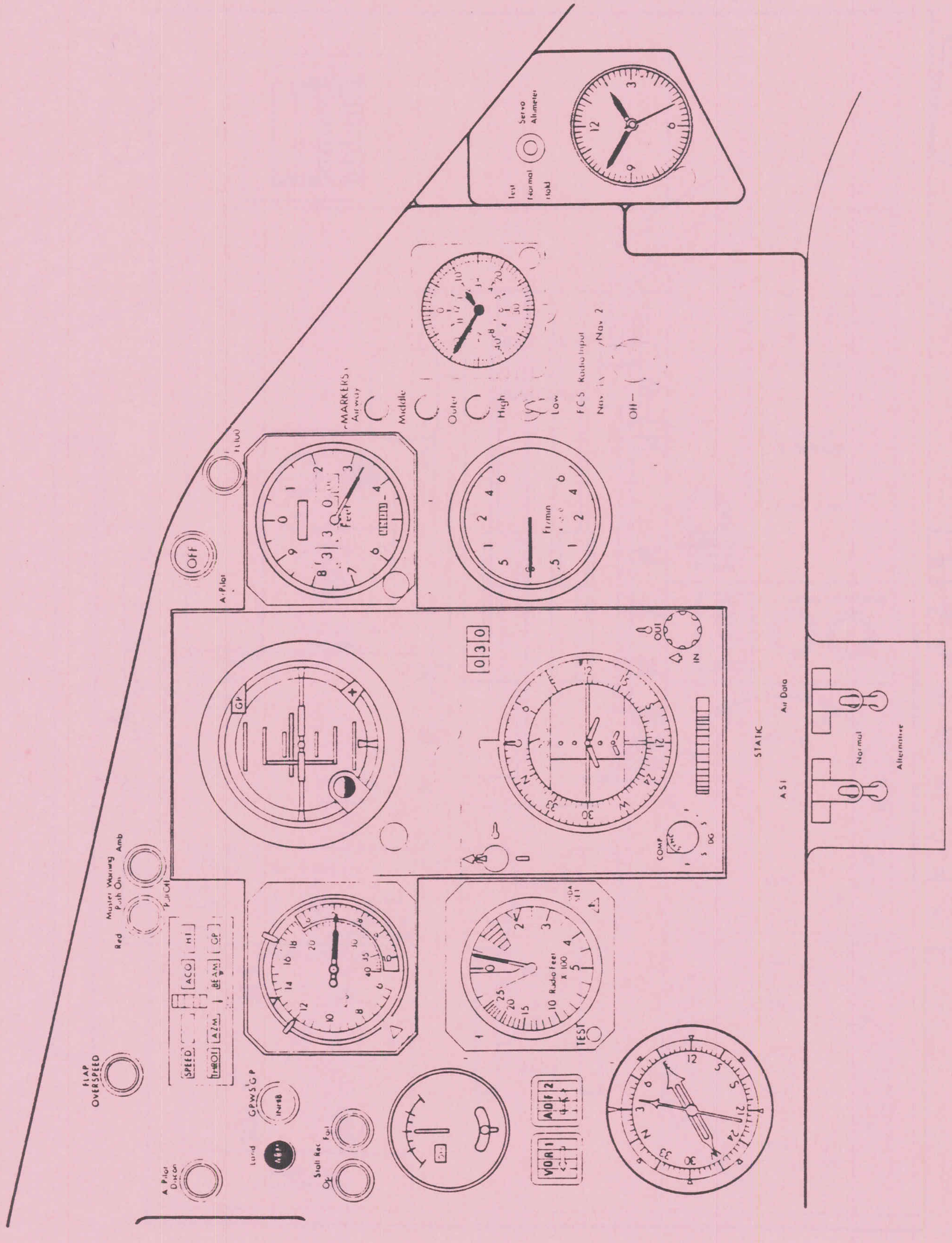
Ⓔ NOSE GEAR



S1-11 ROOF PANEL

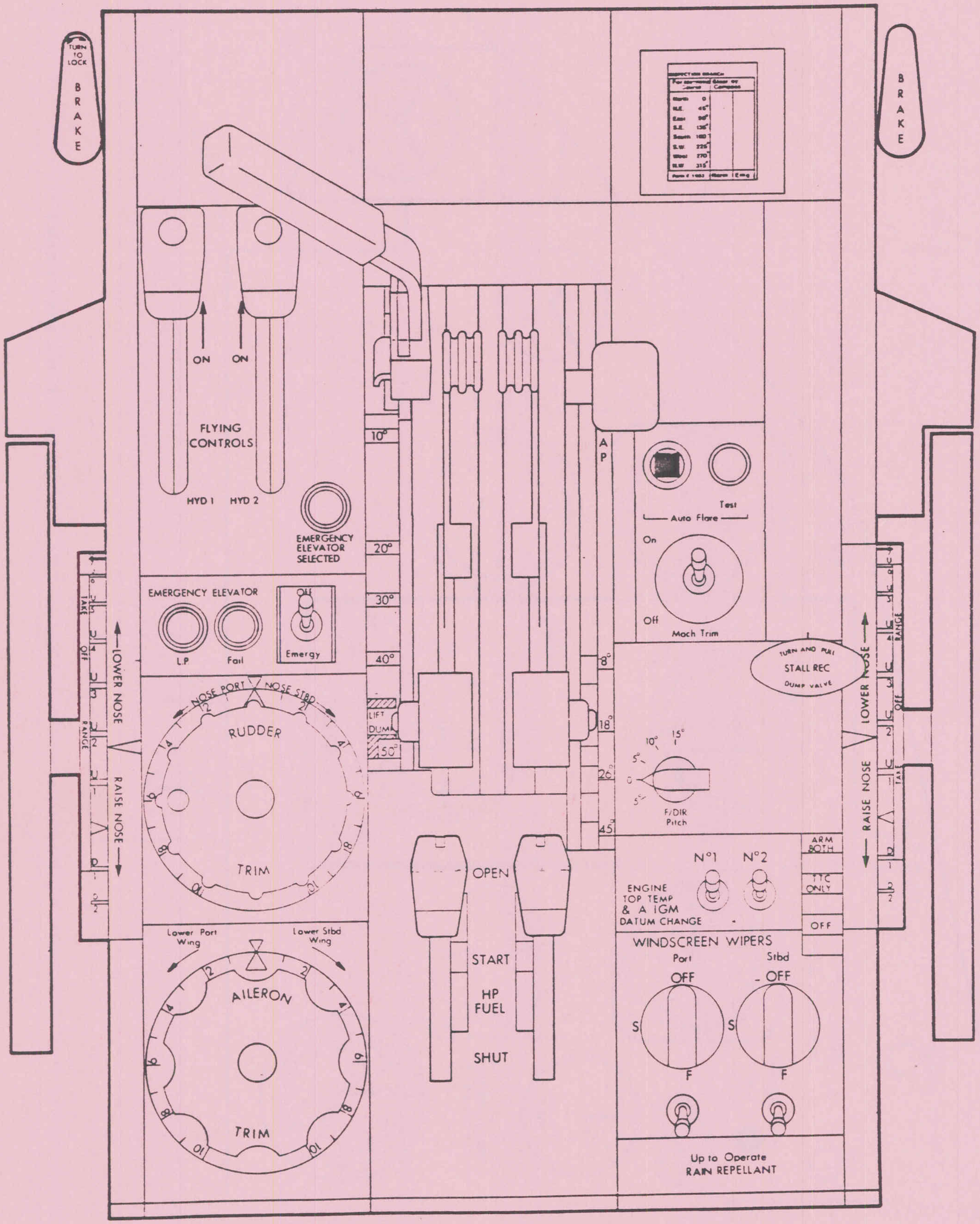


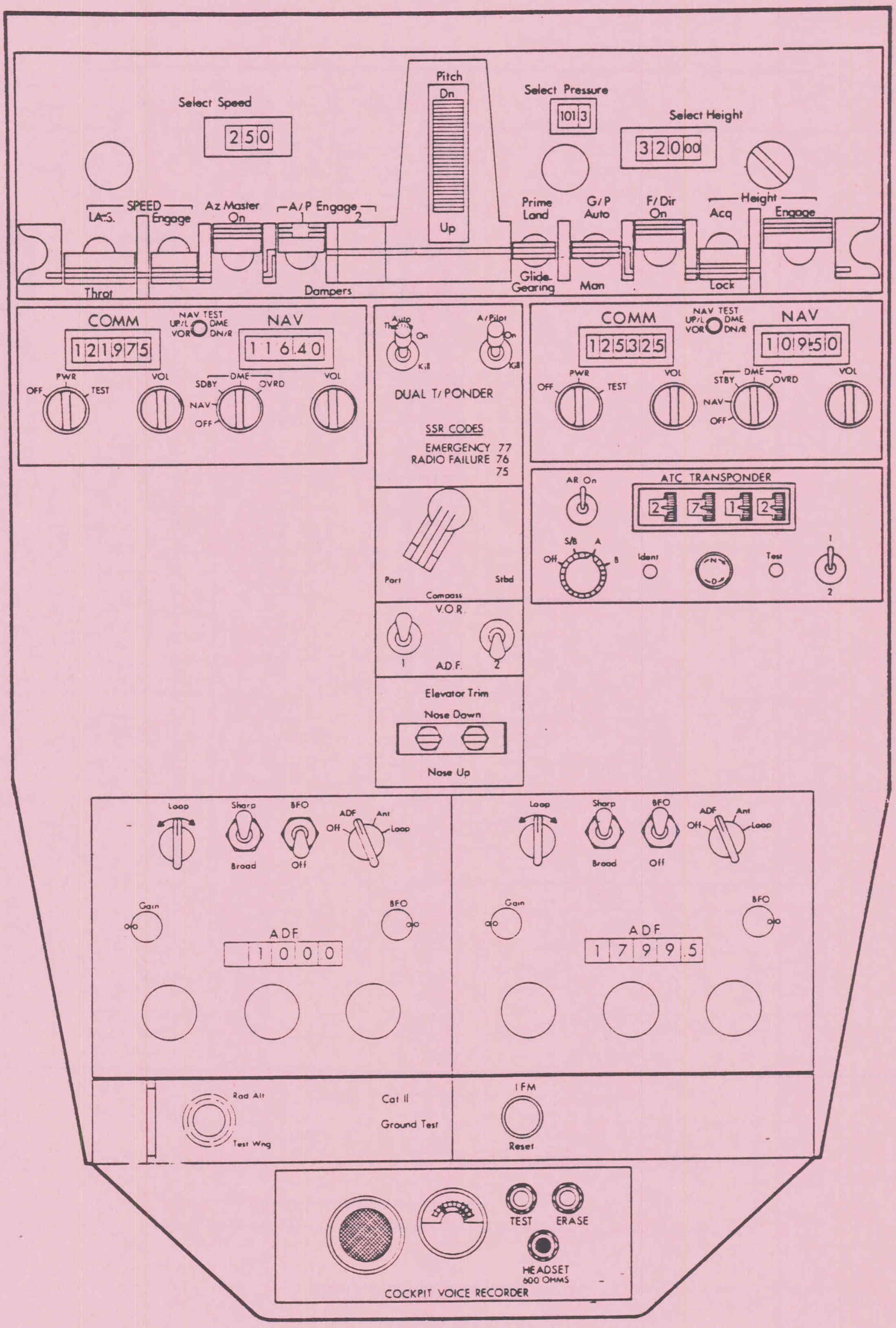
S1-11 Capt's Inst. Panel



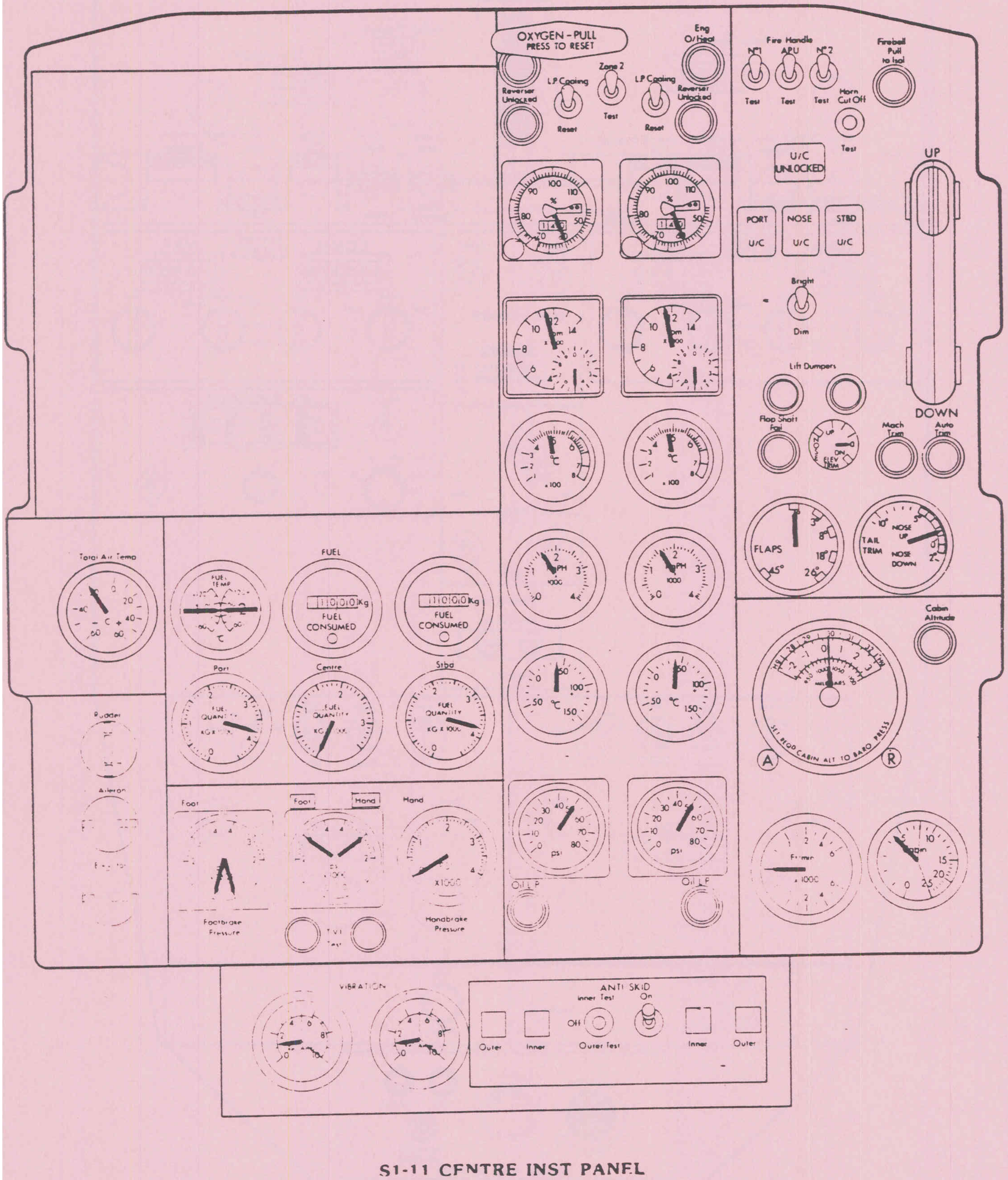
S1-11 F/O's INST PANEL

S1-11 Throttles

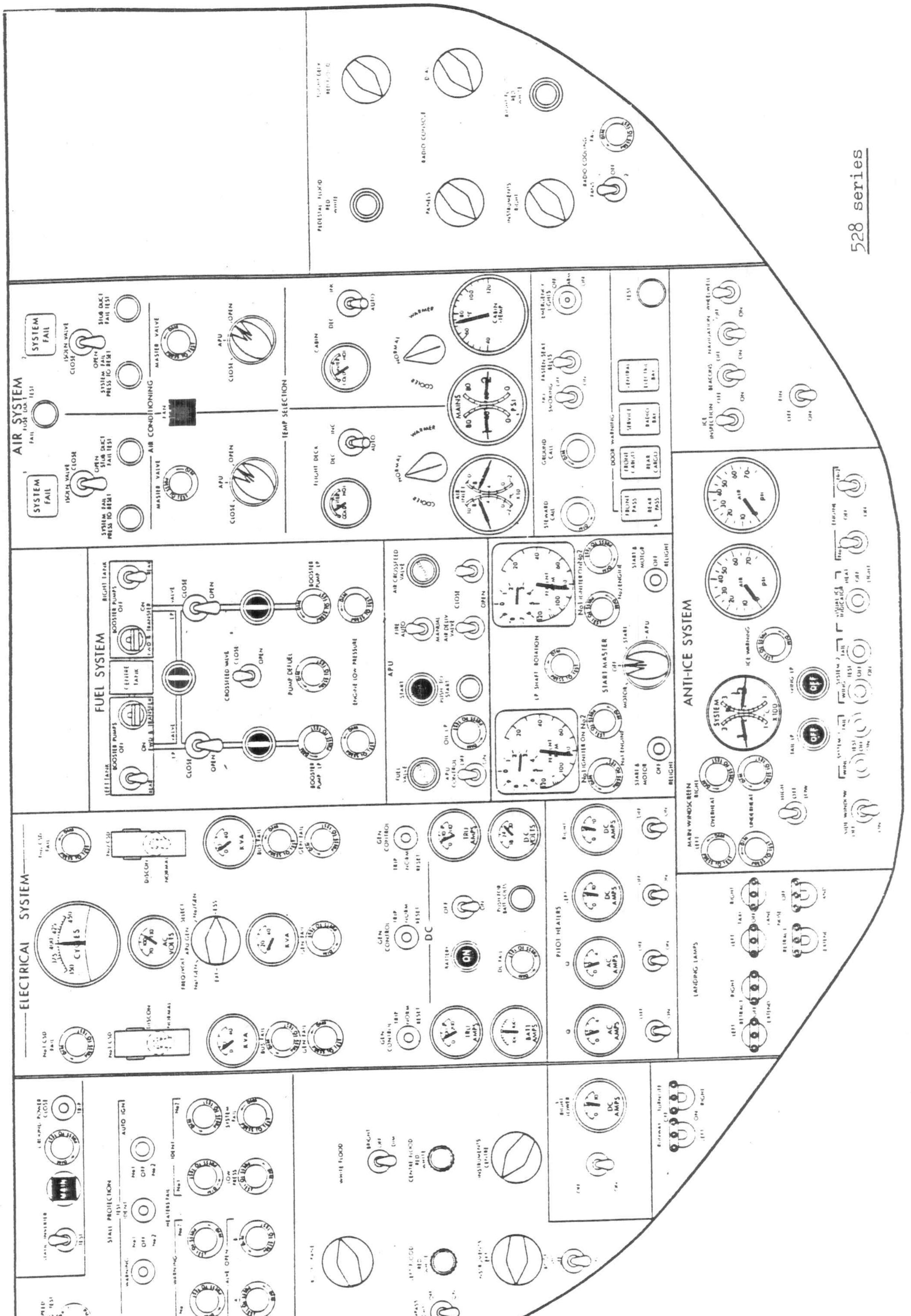




S1-11 PEDESTAL



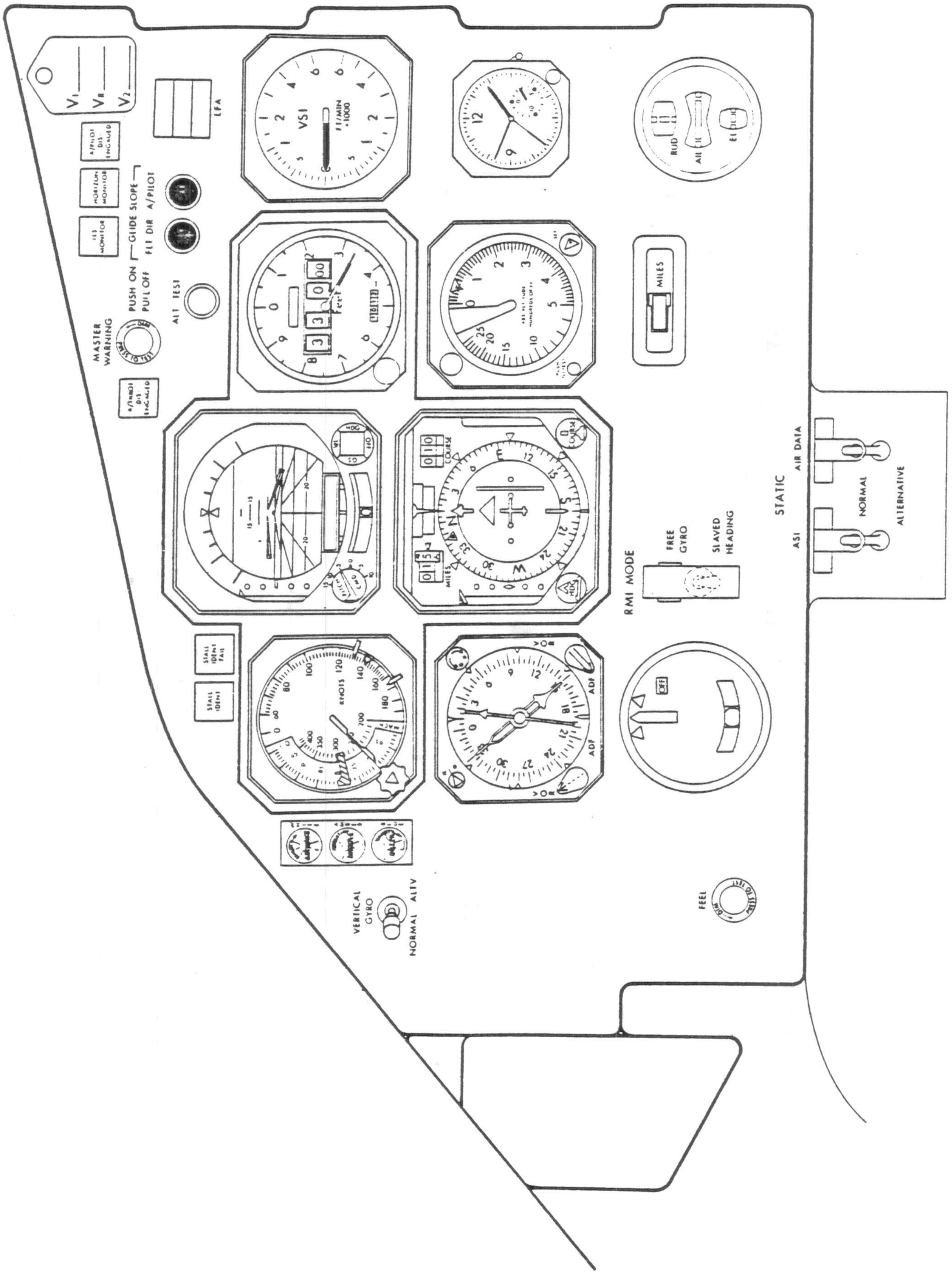
S1-11 CENTRE INST PANEL

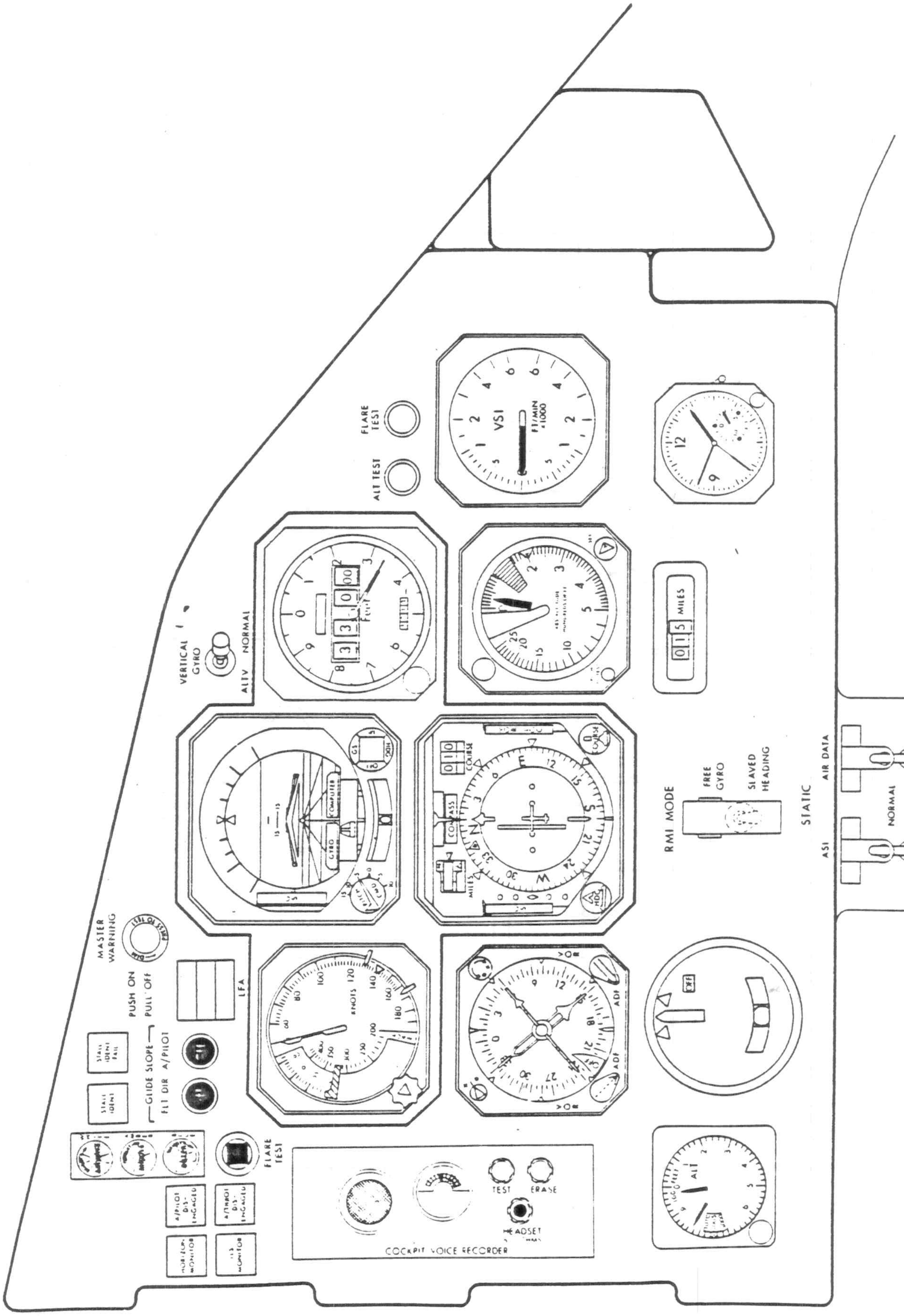

AIR SYSTEM
AIR CONDITIONING
TEMP SELECTION
SYSTEM FAIL
MASTER VALVE
CABIN
FLIGHT DECK
MAINS
PSI
DOOR WARNING
FUEL SYSTEM
BOOSTER PUMPS
CROSSFEED VALVE
ENGINE LOW PRESSURE
APU
START MASTER
ANTI-ICE SYSTEM
ELECTRICAL SYSTEM
CYCLES
AC VOLTS
KVA
DC
BATT AMPS
DC AMPS
AC AMPS
PITOT HEATERS
LANDING LAMPS
STALL PROTECTION
WHITE FLOOD
INSTRUMENTS
RADIO CONSOLE
PANELS

528 series

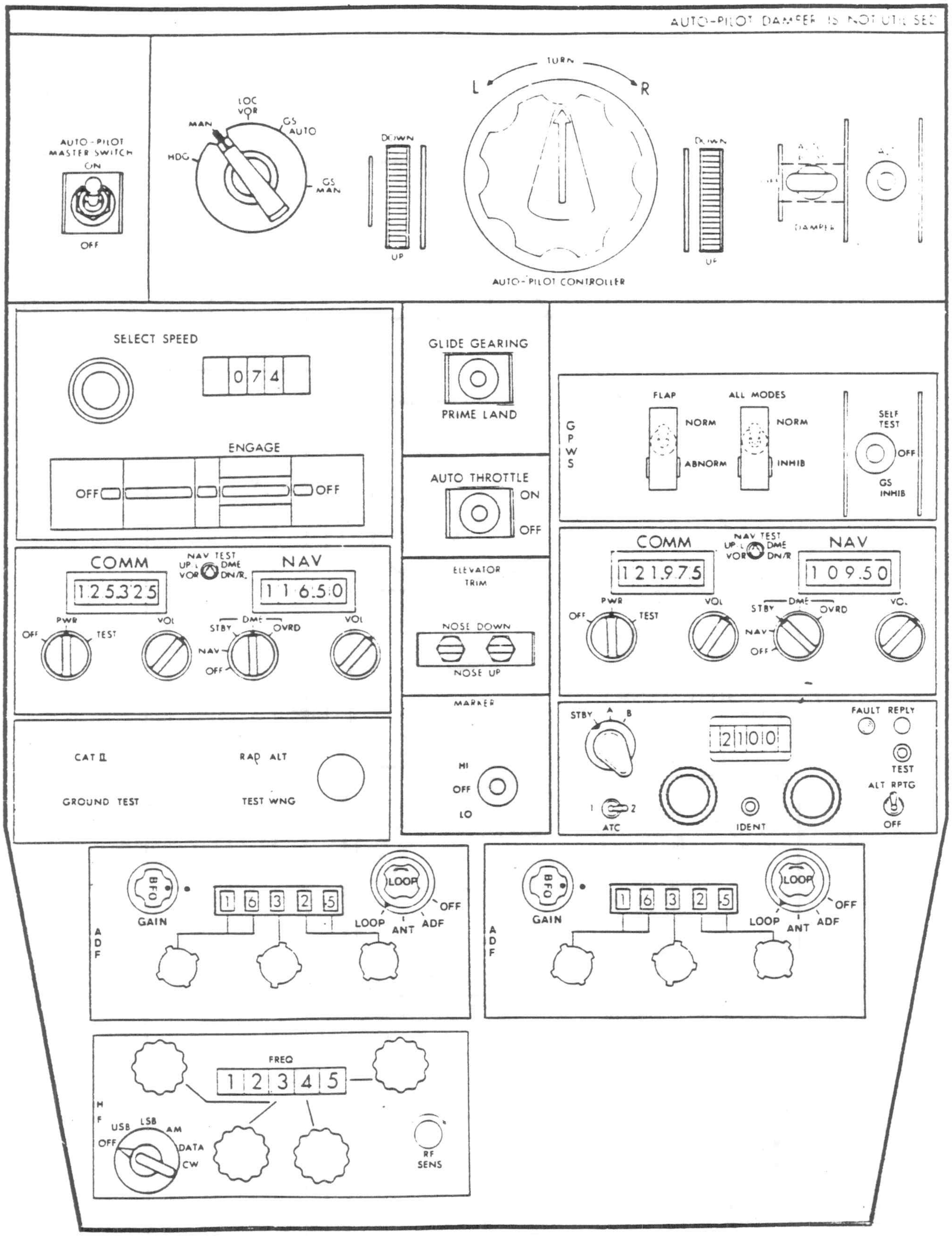
CAPT's INST PANEL

528 series





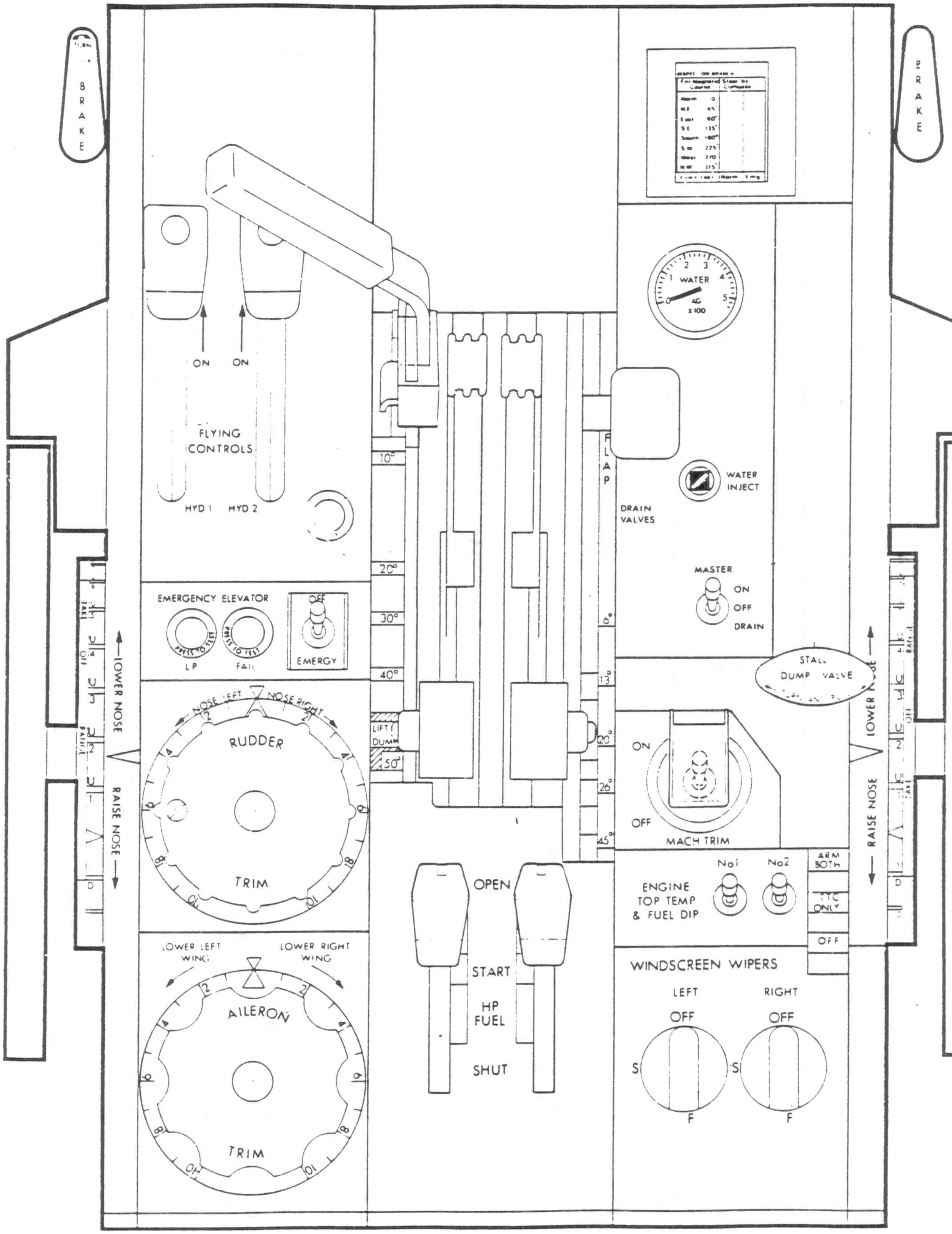
528 series **F/O's INST PANEL**



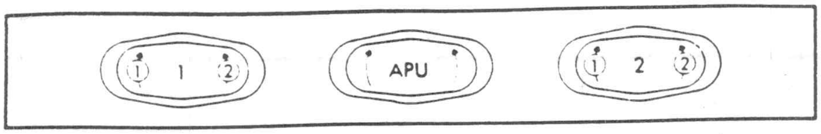
528 series

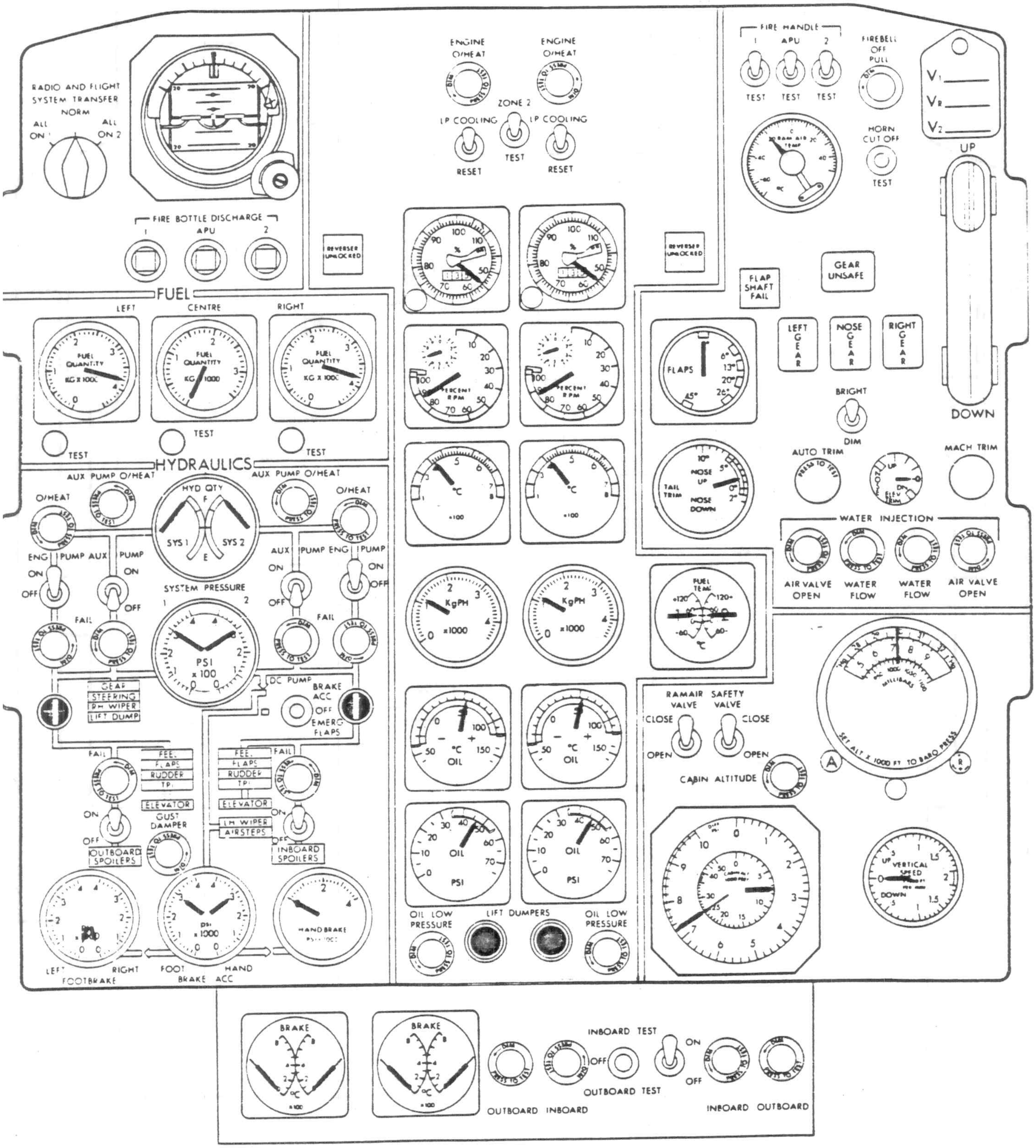
PEDESTAL

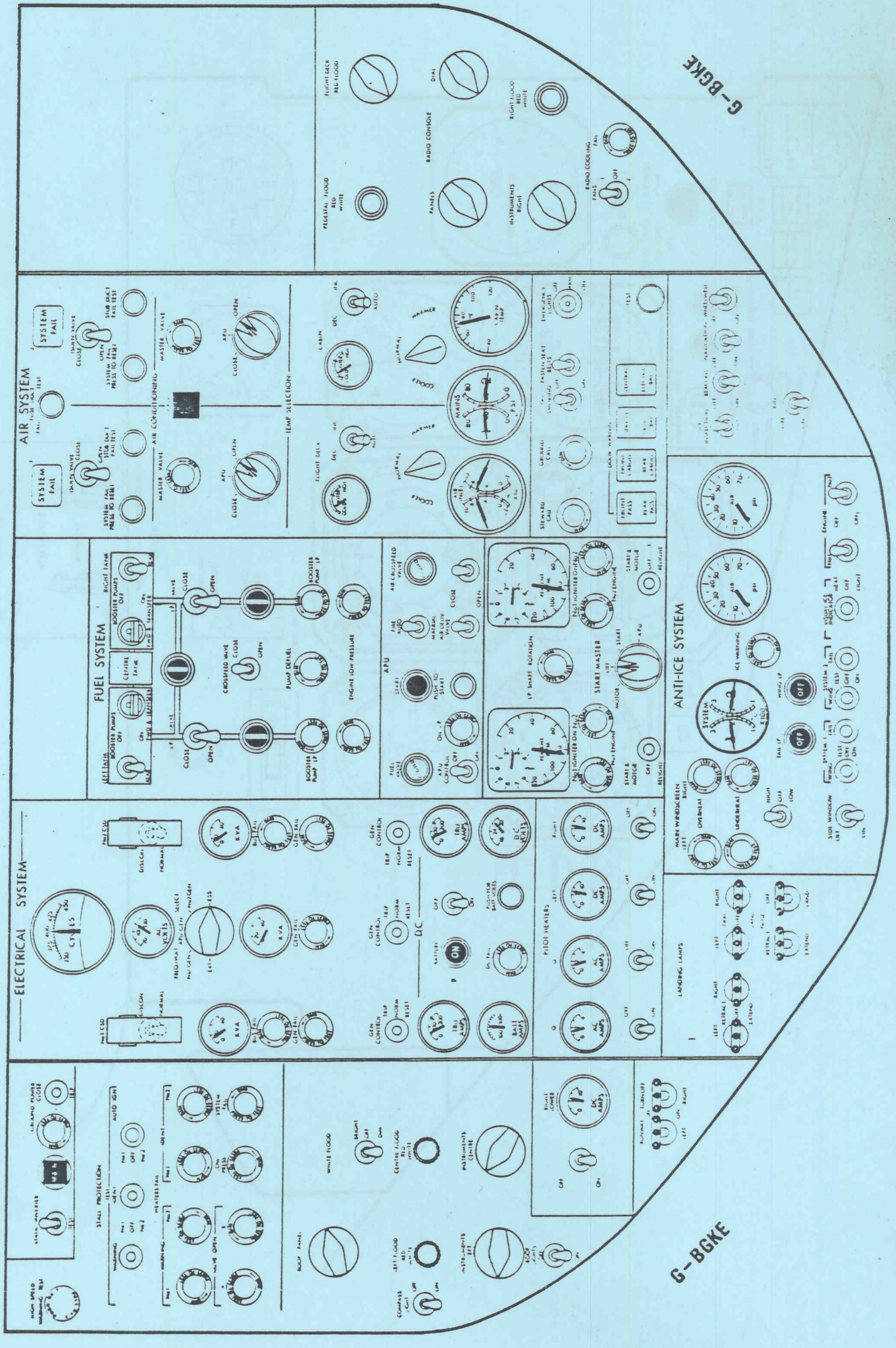
528 series

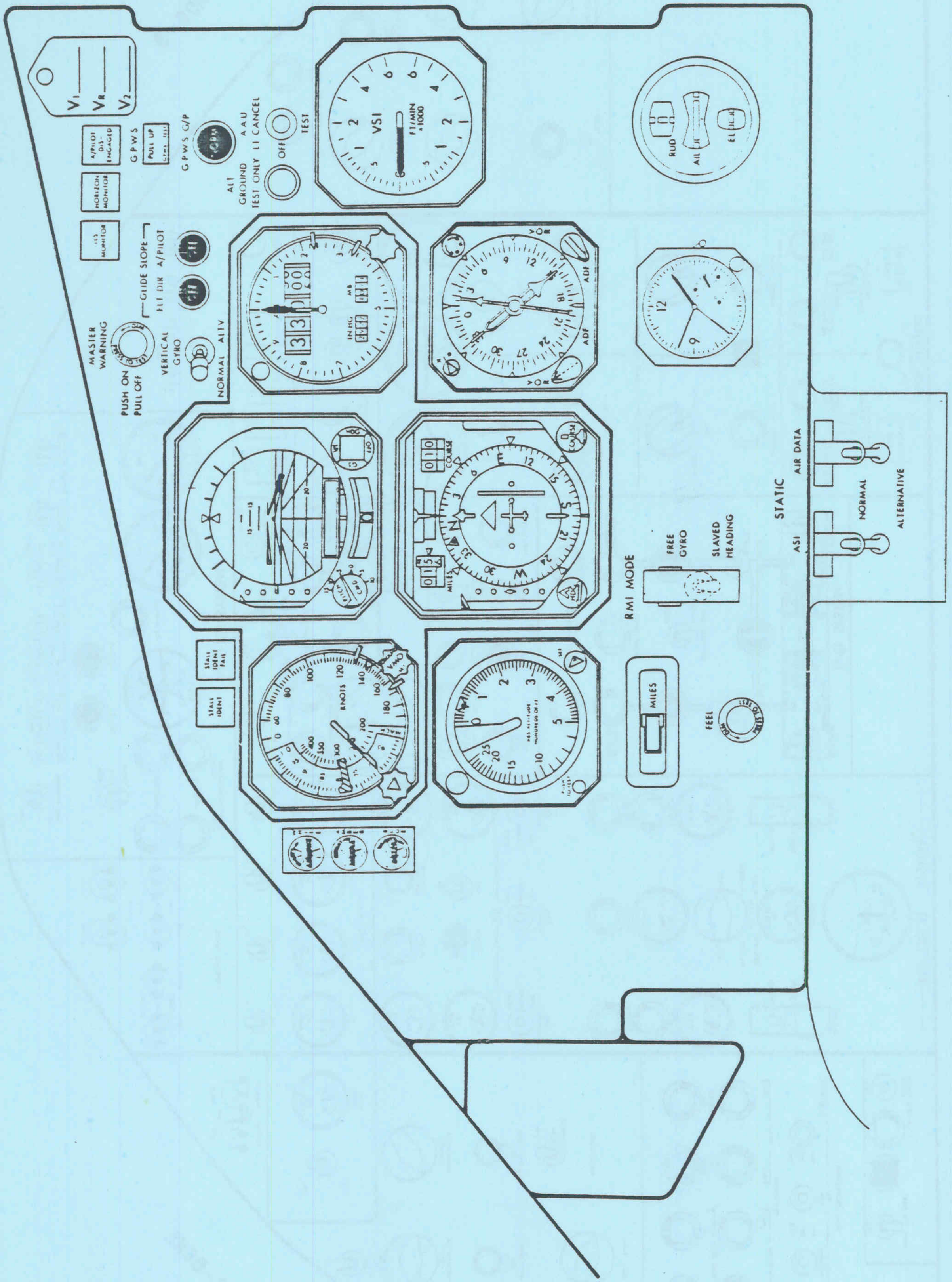

BRAKE
BRAKE
For Magnetic Course
Steer by Compass
North 0
NE 45°
East 90°
SE 135°
South 180°
SW 225°
West 270
NW 315°
ON
ON
FLYING CONTROLS
HYD 1
HYD 2
WATER
1 2 3 4 5
KG x 100
FLAP
WATER INJECT
DRAIN VALVES
MASTER
ON
OFF
DRAIN
10°
20°
30°
40°
LIFT DUMP
50°
6°
13°
20°
26°
45°
EMERGENCY ELEVATOR
PRESS TO TEST
LP
PRESS TO TEST
FAIL
OFF
EMERGY
LOWER NOSE
RAISE NOSE
NOSE LEFT
NOSE RIGHT
RUDDER
TRIM
2 4 6 8 10
STALL
DUMP VALVE
ON
OFF
MACH TRIM
OPEN
START
HP FUEL
SHUT
ENGINE TOP TEMP & FUEL DIP
No1
No2
ARM BOTH
TTC ONLY
OFF
LOWER LEFT WING
LOWER RIGHT WING
AILERON
TRIM
WINDSCREEN WIPERS
LEFT
RIGHT
OFF
OFF
S
F
S
F
LOWER NOSE
RAISE NOSE

528 series

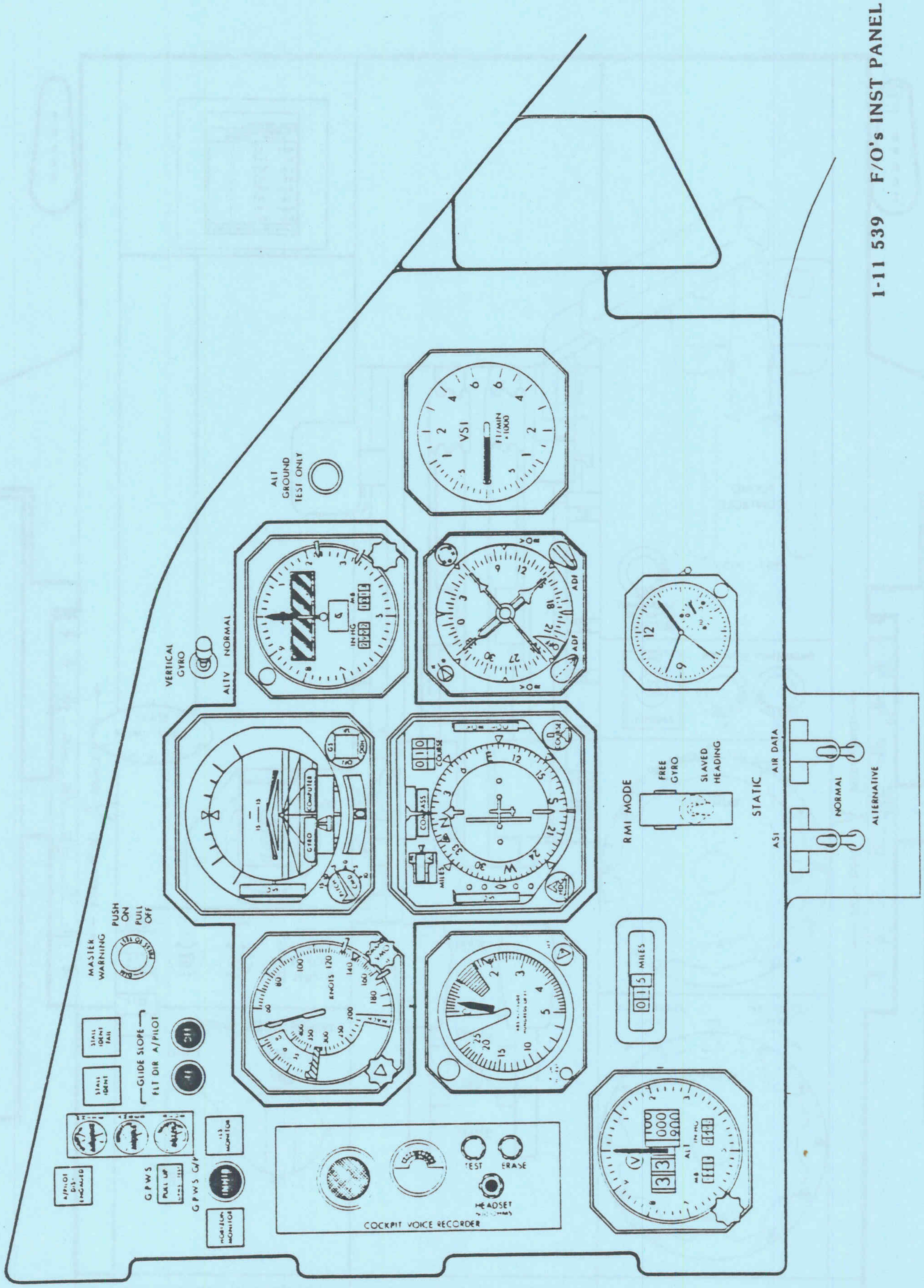

APU

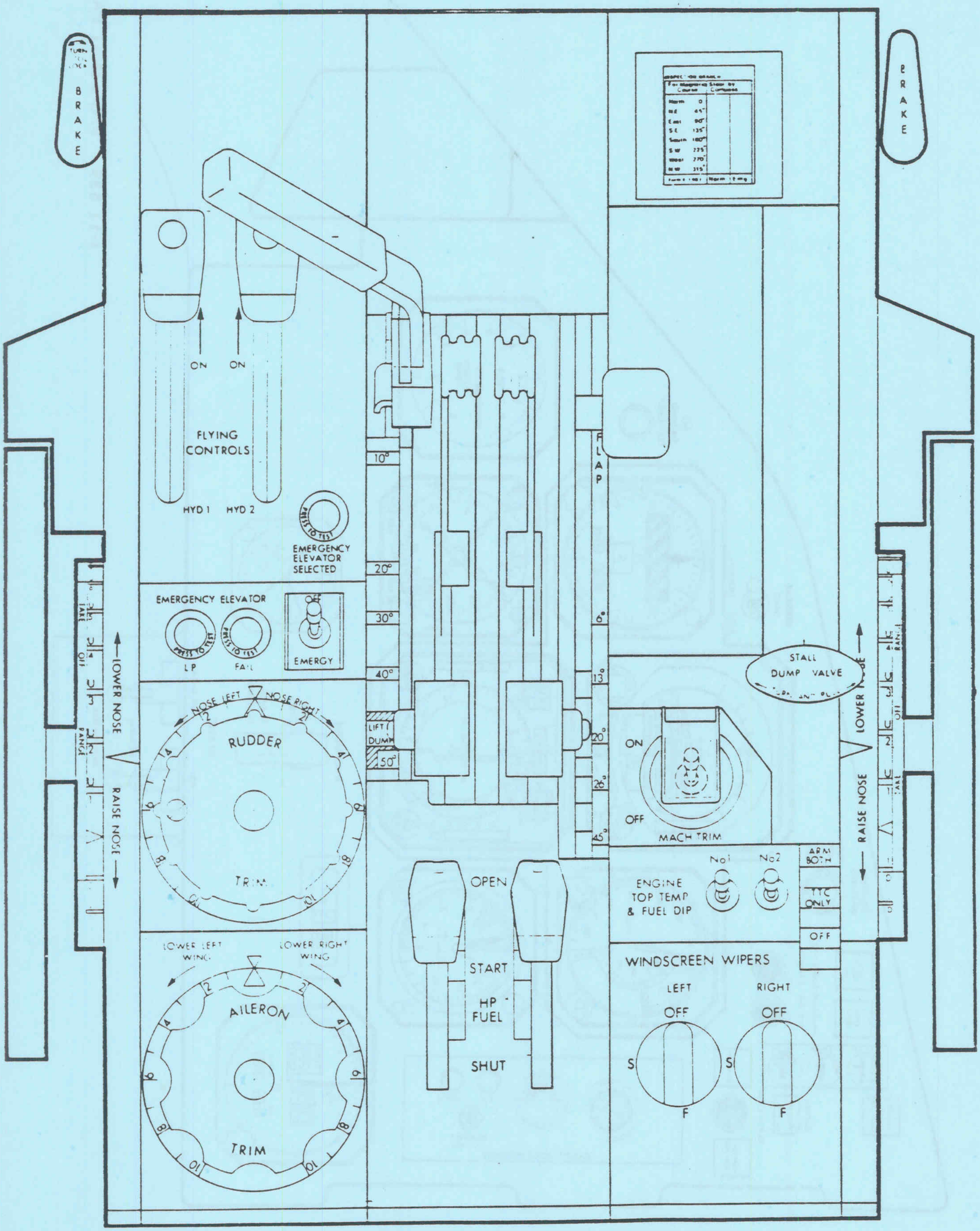

RADIO AND FLIGHT SYSTEM TRANSFER
NORM
ALL ON 1
ALL ON 2
FIRE BOTTLE DISCHARGE
1
APU
2
REVERSER UNLOCKED
ENGINE O/HEAT
ZONE 2
LP COOLING
RESET
TEST
FIRE HANDLE
1
APU
2
TEST
FIREBELL OFF PULL
HORN CUT OFF
TEST
RAM AIR TEMP
V1
VR
V2
UP
DOWN
FLAP SHAFT FAIL
GEAR UNSAFE
LEFT GEAR
NOSE GEAR
RIGHT GEAR
BRIGHT
DIM
FLAPS
AUTO TRIM
MACH TRIM
TAIL TRIM
NOSE UP
NOSE DOWN
ELEV TRIM
WATER INJECTION
AIR VALVE OPEN
WATER FLOW
WATER FLOW
AIR VALVE OPEN
FUEL
LEFT
CENTRE
RIGHT
FUEL QUANTITY
KG x 1000
TEST
PERCENT RPM
°C x100
KgPH x1000
FUEL TEMP °C
°C OIL
OIL PSI
HYDRAULICS
AUX PUMP O/HEAT
O/HEAT
HYD QTY
F
E
SYS 1
SYS 2
ENG PUMP
AUX PUMP
ON
OFF
FAIL
SYSTEM PRESSURE
PSI x 100
GEAR
STEERING
RH WIPER
LIFT DUMP
DC PUMP
BRAKE ACC
OFF
EMERG FLAPS
FEEL
FLAPS
RUDDER
TP
ELEVATOR
GUST DAMPER
OUTBOARD SPOILERS
LH WIPER
AIRSTEPS
INBOARD SPOILERS
LEFT
RIGHT
FOOTBRAKE
FOOT
HAND
BRAKE ACC
PSI x 1000
HAND BRAKE
OIL LOW PRESSURE
LIFT DUMPERS
RAMAIR VALVE
SAFETY VALVE
CLOSE
OPEN
CABIN ALTITUDE
SET ALT x 1000 FT TO BARO PRESS
MILLIBARS
A
R
VERTICAL SPEED
UP
DOWN
BRAKE
°C x100
INBOARD TEST
ON
OFF
OUTBOARD TEST
OUTBOARD
INBOARD
INBOARD
OUTBOARD
PRESS TO TEST
DIM

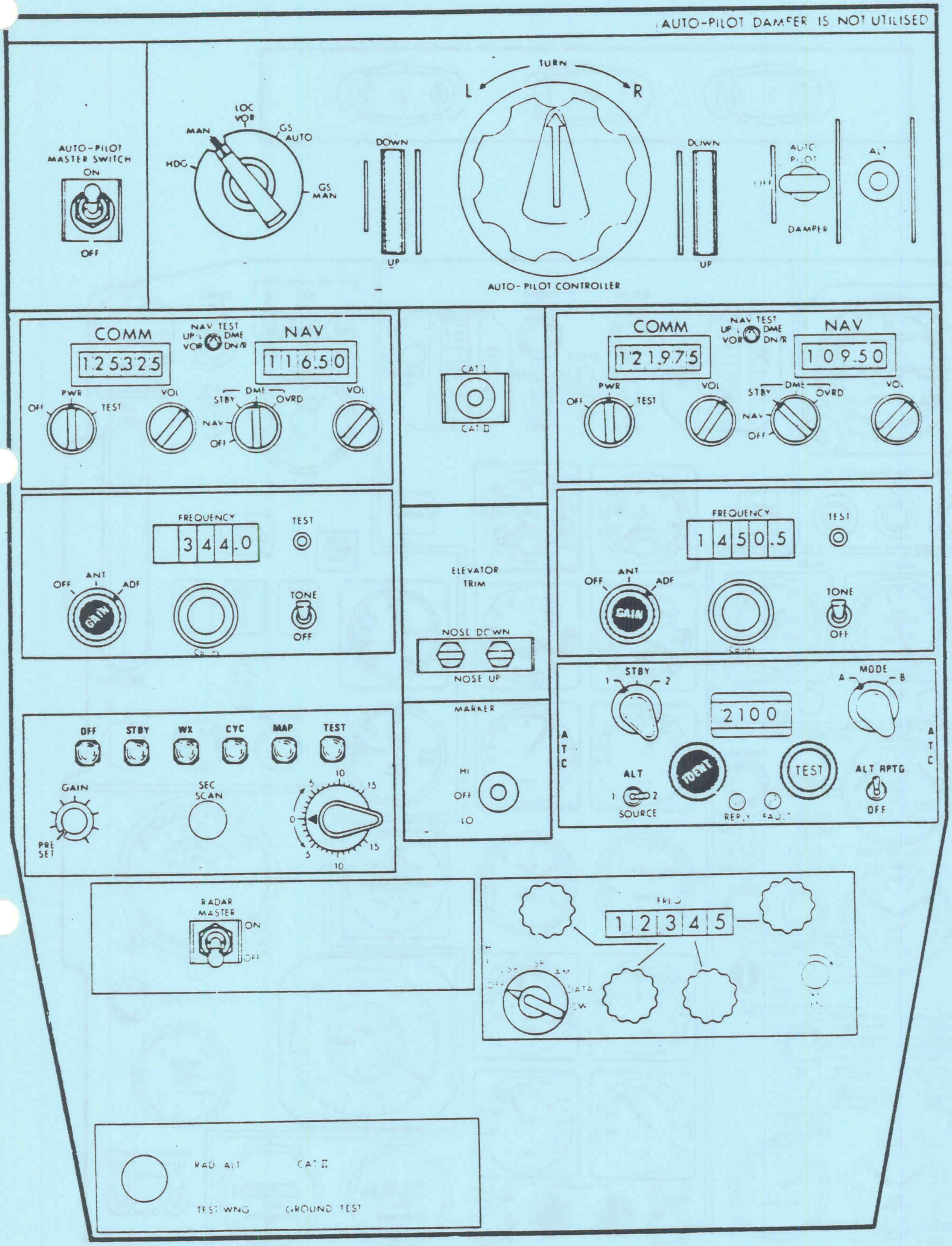

G-BGKE
AIR SYSTEM
SYSTEM FAIL
AIR CONDITIONING
TEMP SELECTION
FUEL SYSTEM
APU
START MASTER
ANTI-ICE SYSTEM
ELECTRICAL SYSTEM
DC
PITOT HEATERS
LANDING LAMPS
STALL PROTECTION
G-BGKE



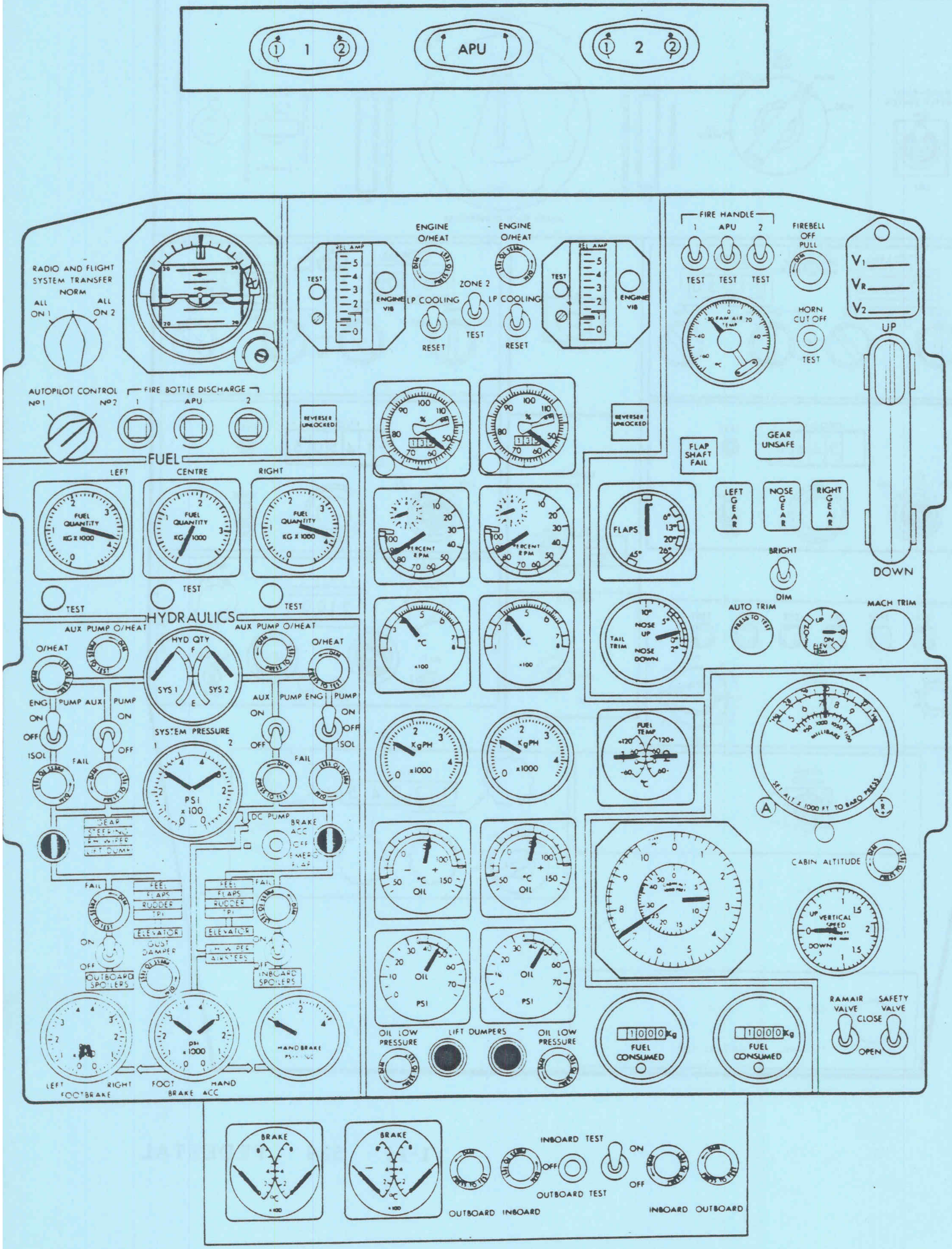
1-11 539 CAPT's INST PANEL


1-11 539 F/O's INST PANEL


BRAKE
BRAKE
ON
ON
FLYING CONTROLS
HYD 1
HYD 2
PRESS TO TEST
EMERGENCY ELEVATOR SELECTED
EMERGENCY ELEVATOR
PRESS TO TEST
PRESS TO TEST
LP
FAIL
OFF
EMERGY
10°
20°
30°
40°
LIFT DUMP
50°
FLAP
6°
13°
20°
26°
45°
STALL DUMP VALVE
ON
OFF
MACH TRIM
LOWER NOSE
RAISE NOSE
LOWER NOSE
RAISE NOSE
NOSE LEFT
NOSE RIGHT
RUDDER
TRIM
LOWER LEFT WING
LOWER RIGHT WING
AILERON
TRIM
OPEN
START
HP FUEL
SHUT
ENGINE TOP TEMP & FUEL DIP
No1
No2
ARM BOTH
TTC ONLY
OFF
WINDSCREEN WIPERS
LEFT
RIGHT
OFF
OFF
S
F
S
F



1-11 539 PEDESTAL


1
APU
2
RADIO AND FLIGHT SYSTEM TRANSFER
NORM
ALL ON 1
ALL ON 2
AUTOPILOT CONTROL
Nº1
Nº2
FIRE BOTTLE DISCHARGE
1
APU
2
REVERSER UNLOCKED
ENGINE O/HEAT
ENGINE O/HEAT
REL AMP
TEST
ENGINE VIB
LP COOLING
ZONE 2
TEST
RESET
FIRE HANDLE
1
APU
2
TEST
FIREBELL OFF PULL
HORN CUT OFF
TEST
RAM AIR TEMP
°C
V1
VR
V2
UP
DOWN
%
PERCENT RPM
FLAP SHAFT FAIL
GEAR UNSAFE
LEFT GEAR
NOSE GEAR
RIGHT GEAR
FLAPS
BRIGHT
DIM
AUTO TRIM
PRESS TO TEST
MACH TRIM
TAIL TRIM
NOSE UP
NOSE DOWN
FUEL
LEFT
CENTRE
RIGHT
FUEL QUANTITY
KG X 1000
TEST
HYDRAULICS
AUX PUMP O/HEAT
O/HEAT
HYD QTY
F
E
SYS 1
SYS 2
ENG
PUMP
AUX
ON
OFF
ISOL
FAIL
SYSTEM PRESSURE
PSI
x 100
KgPH
x1000
FUEL TEMP
°C
MILLIBARS
SET ALT 1000 FT TO BARO PRESS
CABIN ALTITUDE
VERTICAL SPEED
GEAR
STEERING
RH WIPER
LIFT DUMP
DC PUMP
BRAKE ACC
OFF
EMERG FLAP
FEEL
FLAPS
RUDDER
TPI
ELEVATOR
GUST DAMPER
H W PEE
AIRSTEER
OUTBOARD SPOILERS
INBOARD SPOILERS
OIL
PSI
OIL LOW PRESSURE
LIFT DUMPERS
FUEL CONSUMED
Kg
RAMAIR VALVE
SAFETY VALVE
CLOSE
OPEN
LEFT
RIGHT
FOOTBRAKE
FOOT
HAND
BRAKE ACC
psi x1000
HAND BRAKE
BRAKE
°C
x100
OUTBOARD
INBOARD
INBOARD TEST
OUTBOARD TEST
ON
OFF
INBOARD
OUTBOARD

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